SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1899, by Munn & Co.]

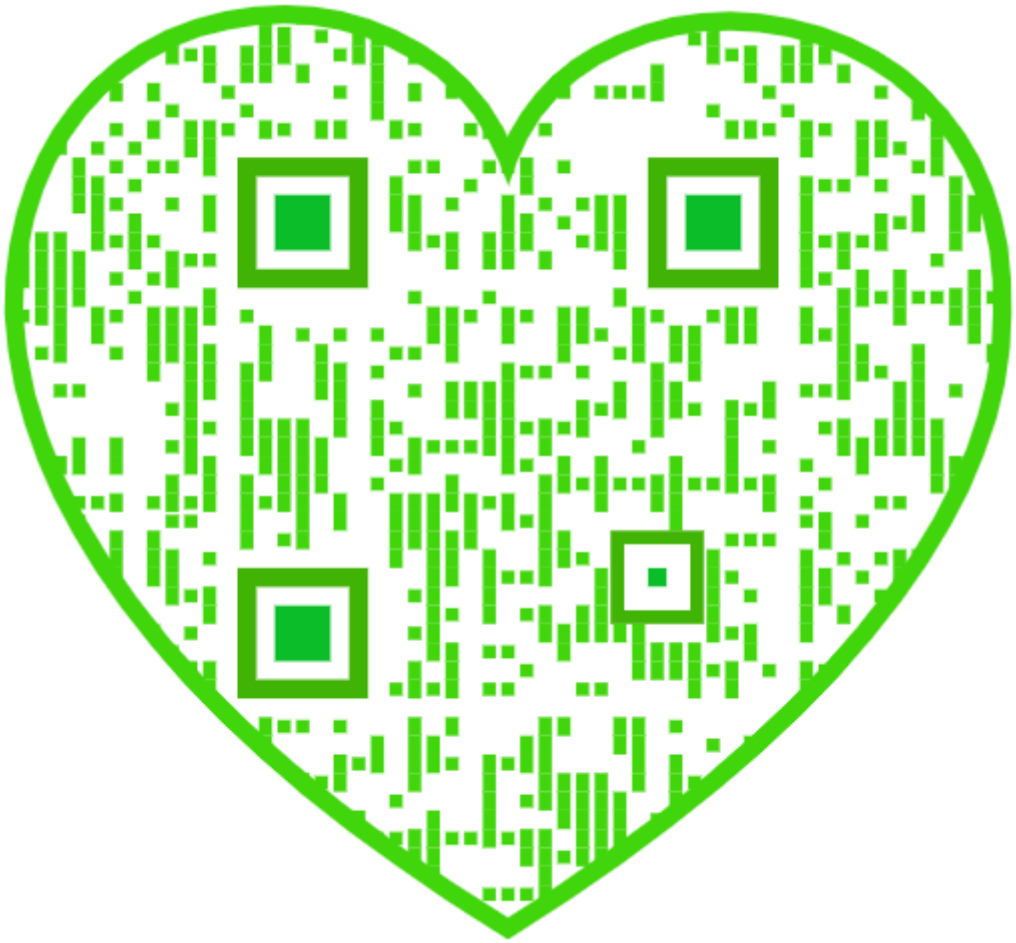
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXX.—No. 19. ESTABLISHED 1845. NEW YORK, MAY 13, 1899. [$3.00 A YEAR. WEEKLY.

ELECTRIC SURREY IN OPERATION.

ELECTRIC SURREY CONSTRUCTED ON "THE RIKER SYSTEM," SHOWING DETAILS OF WORKING PARTS.—[See page 295.]

© 1899 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876)..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, MAY 13, 1899.

THE CHARM OF THE BICYCLE.

The philosophers tell us that one of the most powerful motives that govern human life is the love of power; that the exercise of power, showing itself in some visible effect, is accompanied with pleasurable emotion, and that the degree of pleasure depends upon the smallness of the effort compared with the magnitude of the effect. It is claimed that this love of producing effect shows itself at the very threshold of life in the preference of the infant for toys that produce sounds or exhibit motions, and it is probably because the result is so disproportionate to the effort that the boy finds unalloyed delight in the noise of a drum or the screech of a tin horn.

The same philosophy tells us that the politician, the soldier, the leaders in the world of finance, and, indeed, all men who exert a powerful influence upon the destiny of their fellows, are consciously or unconsciously actuated to a large degree by the same passion for producing effect, and producing large effect with the smallest expenditure of effort. Certain it is, that the delight with which we contemplate achieved success is always heightened if that success has been won with a disproportionate effort or loss. The victories of Manila and Santiago, great as they were in themselves, take on a special glory from the fact that in those two conflicts we destroyed a navy and won an empire with practically no hurt to ourselves. Our successful invasion of foreign markets has aroused the national enthusiasm, not merely because it means increased trade and enhanced prosperity, but because the extraordinary ease with which, at the first attempt, we have captured these foreign markets, appeals to our sense of power and testifies to the latent energy of the race.

But coming a little closer to our subject, we find that in the world of sport, and especially among those devotees who are entitled to the designation of true sportsmen, this love of power and the desire to perform exceptional feats of skill and endurance with the least expenditure of visible effort, is the supreme motive. Indeed, we doubt if any surer test of the quality of an amateur sportsman can be found than the degree in which he is actuated by this spirit to the exclusion, or rather the subordination, of all other motives. The ideal sportsman engages in combats of strength and skill, not with a view of capturing some reward in the shape of money, jewelry, or medals, not merely for the pleasure of "downing" his opponent, not alone for the grand stand applause—although all of these are perfectly proper motives in their place and degree. The ideal sportsman is he who aims to break the record first and last for the sake of the sport itself, and who finds his highest reward in the contemplation of the fact that the mark (whatever it may be) has been placed so much higher with so much greater ease (if such be the case) than ever before. The delight of the audience is always greater if the winning horse come in without the incentive of whip and spur, or if the popular sprinter cross the tape watching his beaten opponent over his shoulder, or if the champion cyclist of the year sweeps through the "bunch" from the rear and "sits up," an easy winner, a yard or two before the tape is reached.

Looking at the active sports as a whole, it will be found that their relative popularity is largely determined by the degree of skill, the swiftness of motion accomplished in proportion to the smallness of the effort that must be exerted. Hence the enormous and sudden popularity of certain games over others. Note the sudden extinction of the amiable, but imbecile game of croquet, by the swifter game of lawn tennis, and this, in turn, by golf, with its far-reaching links and its "drives," measured by the hundreds of yards.

It is when we consider the modern pastime of bicycling, however, that we meet with the most striking exhibition of the strength of this desire to do much and do it with comparatively little effort. It is because the bicycle enables us to travel so far afield with such an astonishingly small expenditure of effort that it has achieved its sudden and world-wide popularity. Of course, there are other contributory causes, such as the desire for exercise; the opportunity given to those who cannot afford to keep a carriage to get out into the scenes and sweet air of the country; and to many people the saving of time and expense in transacting their daily business; but these considerations alone do not account probably for one-tenth of the millions of people who day by day and week by week are to be found reeling off the miles with a persistence which might make one suppose that wheeling was as necessary a part of their existence as breathing or the circulation of the blood—and to not a few of them, indeed, it is as necessary.

Fresh air, green fields, the song of birds, the ever-changing panorama of the countryside, the quickened sensibilities of mind and body all are accessory pleasures of the wheel; but the deep, underlying charm of it all is the sense of achieving this swift motion at as little expenditure of effort as would be necessary in walking for half a dozen blocks in a city thoroughfare. Who will ever forget his first bona fide country ride on a good level road, undertaken as soon as the problems of equilibrium had been mastered, and the thrill of exultation with which he found that the same muscular effort which moved him at three miles an hour on his legs, is now sufficient to carry him at twelve miles an hour on his wheel. The result seems so absurdly disproportioned to the effort, as to create a half belief that one's own physical strength must have redoubled. Certain it is that one's sense of power is most pleasurably affected, and the persistent protest of the mind against the inertia of things material is silenced for the while.

And, after all, speaking of the inertia of things, the bicycle is only one expression of the great world-struggle of mind to overcome the inertia of matter.

The history of the arts and sciences, and especially of those which concern travel and intercommunication, is the history of man's successful effort to set in motion the latent energies, the inert masses of nature, and hence there is a strict relation between the development of transportation and the growth of our material wealth and comfort. The craze for "breaking the record," whether it be on the train, the steamship, or the wheel, is prompted by something more than the mere love of the spectacular; for the world recognizes that every new performance is a further breaking away from that universal stagnation in which all matter lay before its present evolution began—a stagnation which it is the constant effort of our modern arts and sciences to overcome.

RECORDS OF SPEED AND ENDURANCE ON THE BICYCLE.

Although the great majority of riders are content to travel at a comfortable speed of from 8 to 10 miles an hour, and have neither the inclination nor the ability to ride faster for any length of time, the great crowds that witness the trials of speed and endurance, week by week during the racing season, testify to the fact that the riding public is deeply interested in the possibilities of speed and endurance on the bicycle as shown by the racing cyclist. The racing enthusiast is well versed in the standing of the records for various distances and times, and carries them, indeed, at his fingers' ends; but there are many riders to whom a statement of what has actually been achieved would come with a shock of surprise. We are all aware that some phenomenal speeds have been recorded, but there are probably few who appreciate the fact that a mile has been ridden on the track at the rate of between 39 and 40 miles an hour, or that a rider has covered 34¼ miles in a single hour, or that yet another has rolled off 616 miles in a single day, or that—perhaps most wonderful of all—a fourth rider has ridden over 2,100 miles in the space of six days, while a fifth has traveled two hundred and fifty consecutive centuries on as many consecutive days, thus covering 25,000 miles in a little over eight months of the year.

The full meaning of these figures can best be realized by comparison. A mile in 1 minute 31⅘ seconds, as made by Taylor at Philadelphia, is just under 40 miles an hour, which is as fast as or faster than the scheduled running time, including stops, of many of the crack expresses between New York and Chicago. Compare Elke's feat of riding 34¼ miles in an hour at Philadelphia with the speed of the so-called local express trains out of this city. It means that, if a suitable track were laid down to some outlying town 30 or 40 miles from New York, the rider in question could start for home in the evening at the same hour as the train and reach his destination several minutes earlier than he could on the cars. On September 16, 1897, Cordang rode for 24 hours at an average speed of 25·7 miles an hour, covering a total distance of over 616 miles. One extraordinary feature of this performance was the fact that the pace was faster during the twenty-fourth than during the first hour, and that after the rider had covered 600 miles, he was riding the mile in 1 minute and 56 seconds and 1 minute and 57 seconds, or at the rate of 31 miles an hour. Applying these figures to actual railroad traveling, we find that there are even to-day continuous 600 mile journeys which the traveler will take over 24 hours to complete. If a special track could be laid for the purpose, the same speed would carry a rider from New York to Richmond and back in a single day. Perhaps the most wonderful feat of long distance traveling on record is the ride of Miller made during the winter at San Francisco, when he covered over 2,100 miles in six days of continuous riding. This would be equivalent to riding from San Francisco to Chicago, or over two-thirds of the distance across the continent, in a week, and having one day of the seven for rest at the journey's end. Finally, we have the 25,000 mile ride of Edwards, who, starting on the first day of January, 1898, rode a century every day of the year up to the 7th of September, thus covering a total distance greater than the circumference of the globe in only about 30 per cent more actual riding time than that allowed by Jules Verne for a record trip around the world.

The mile record was made on a chainless wheel of the Sager type geared to 114. The hour, the 24-hour, and the 6-day records were made on chain wheels with gears varying from 96 to 112. The 25,000 mile ride was made on a chainless wheel of the bevel gear type, the same wheel being used throughout and in every kind of weather. The fact that the gears, though worn, were in good working order testifies to the durability of this type of driving mechanism.

These are records as they stand to-day. It must be understood, of course, that the mile, hour, and all-day records were made behind pacing machines. The present season is likely to see the introduction of motor pacing, and we may look for an extensive reduction of these records, remarkable as they are.

OUR SEA-COAST DEFENSES.

A few years ago the country was greatly disturbed over the fact that it had no sea-coast defenses. Now it appears that while we have the defenses, we lack efficiency in the care and handling of the guns. Such, at least, is the burden of a report recently made upon the subject by Captain William Crozier, his complaints being based upon what he saw during a tour of inspection made last November. The matter can best be stated in the Captain's own words:

"I have found in many cases that neither the officers nor men understood or attentively looked after the armament. I have many times had difficulty in getting guns, and especially carriages, properly cleaned for firing test. . . . The officers seem to be without proper standards of performance, and almost no attention was paid to rapidity of fire. . . . When it came to the actual firing of pieces, all efforts at lively work were often abandoned. There has been thus far great neglect of the subject of the pointing of mortars; some batteries which have been completed for years have been during the late war and are now absolutely unserviceable because of inability to point the mortars at a target." The report attributes this lack of interest to the long neglect of the subject during the twenty years following the civil war and to the lack of a liberal policy in the management of artillery matters, particularly in the opportunities for actual practice in loading and firing guns. He suggests, as one important remedy, that there should be on the staff of the commander of the army a chief inspector of artillery, who should make periodical inspections to see that the various orders respecting the details of artillery service are faithfully carried out.

This report will come as a painful surprise, for it shows that we are backward in a service which we thought was being brought up to a state of considerable efficiency. The two defects of slowness of fire and absence of range finders are about as serious as they could well be. Modern warships will try to run by the batteries, and their high speed will carry them through the danger zone very quickly. Vessels that can make a mile in less than three minutes will be a difficult target for guns which (because of slow handling) can fire but one shot in every six minutes. Next to accuracy, rapidity is the great desideratum in a gun detachment.

Mortars sunk in deep pits, with nothing to look at but the blue sky above, are absolutely dependent on distant range finders for locating the enemy, and giving the proper elevation and traverse for the mortar, and a battery of mortars without means for pointing is as useless as a rifle in the hands of a blind man.

It is to be hoped that immediate steps will be taken to reform the abuses which have been so faithfully exposed in this report. It is to the author of this report and to Colonel Buffington, Chief of Ordnance, that we owe much of the excellent material to be found in our defenses, and we trust that under the present regime this important arm of the service will be brought up to the standard, in personnel as well as material, of the best modern practice.

THE FASTEST CRUISER IN THE WORLD.

It seems ridiculous that the nation that is least able to make use of them should possess the fastest torpedo boat and the fastest cruiser in the world. The famous Schichau firm recently built a torpedo boat for China which made 35·2 knots per hour, and now the Armstrongs have completed a 4,400-ton cruiser, the "Hai Tien," which has made a natural draft speed of 22·6 knots and a forced draft speed of 24·1 knots per hour. This is the record for a warship, or, indeed, for any kind of ship of that size. If the "Hai Tien" could maintain that speed across the Atlantic, she would make the passage in about four days and a half.

© 1899 SCIENTIFIC AMERICAN, INC.

AUTOMOBILISM IN PARIS.

Great strides have been made in the world of automobiles within the last eight years. In 1890 Messrs. Serpollet and Archdeacon attempted the journey from Paris to Lyons. The difficulties they encountered from the very commencement were enormous and such as would very soon discourage any automobilist of the present day. Endowed as they were with a more than ordinary degree of perseverance and patience, they succeeded in effecting the journey in the time of ten days! In very truth, "tempora mutantur." Now the distance can be made in as many hours.

In any account of present day automobilism, the name of M. Pierre Giffard, the director of the Velo, and formerly on the staff of the Petit Journal, must be mentioned. Four years ago carriages with mechanical motors were practically unknown. At this time M. Giffard commenced a war against the prejudices of the public on this subject, and with the patronage of the Petit Journal, organized in 1894 the first great automobile race ever witnessed, from Paris to Rouen. Great excitement was manifested as to the issue of the race, and speculations were made as to the relative merits of steam and petroleum. The Count de Dion competed with a steam motor (see the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1080 and 1182), while Messrs. Levassor and Peugeot opposed him with petroleum-driven machines (shown in the SCIENTIFIC AMERICAN for July 20, 1895). Ten competitors appeared at the starting point at Neuilly. According to the regulations, it was not only the speed that would be considered by the judges in awarding the prize; the flexibility and power of endurance of the machines would also receive due allowance.

The race took place, and though the steam-driven machine came in easily first, the prize was not allotted to it alone. Messrs. Levassor and Peugeot were classed as winners on the same level as M. de Dion, and the future of the petroleum-driven motor car was assured. Qualities essentially practical were discovered in it, and the fact that any one, not necessarily an engineer, could steer and manage it, was sufficient assurance of the success it was destined to attain. The race is illustrated and described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 979.

Six months later, at the exhibition of the Salon du Cycle, held in the Palais de l'Industrie, automobile carriages were permitted to appear; the crowd collected round these innovations in steam and petroleum, their interest in the bicycle stands being considerably diminished in favor of these novelties.

The following year it was felt that another race must be run, but this time no conditions should be laid which would leave in doubt the real merit of the different machines. Speed alone should decide the race and the whole unrestricted power of the motors should be exhibited.

The route decided upon was Paris to Bordeaux and back. Subscriptions rolled in, and one hundred thousand francs were quickly raised to meet the organization expenses and to pay for the prizes.

The advocates of steam for motors do not give in. Messrs. de Dion, Serpollet, and Bollée engage actively in the construction of machines which they hope will show to the world its superiority over petroleum.

The advocates of the latter, however, also prepare for an exploit which will, they feel confident, bring confusion and defeat on their rivals.

Electricity as a motor is also taken up by M. Jeantaud (see the SCIENTIFIC AMERICAN for March 23, 1895), who, at considerable expense, obtains a special train to place at periodical stages of the journey between Paris and Bordeaux fresh accumulators, etc., which his carriage is to take up on the way.

On June 10 the automobiles assembled at the Arc de Triomphe, in the presence of an enormous crowd. From there they went, at a moderate pace, to Versailles, where the real start was given. A few kilometers farther on the steam atomobiles come to grief. Twelve hours pass, when news arrives that M. Levassor, on his petroleum auto-car, is an hour and a half ahead of his rivals. Twenty-four hours pass, and already he has reached Bordeaux and is back on the return journey to Paris, crossing his rivals on the road with an advance of four hours. No sign of fatigue either in man or machine can be seen. Porte Maillot is reached at last, the whole distance of 1,200 kilometers having been run in 48 hours 47 minutes. (See the account of the race published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1023.) Signal victory for the petroleum motor. The 1895 race bore fruit immediately. A great project had long been resolved upon in his mind by the Count de Dion to found a club for the defense and encouragement of automobile riding—to create the Automobile Club of France. The race from Paris to Marseilles in 1897 was a great success, and is described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1096.

At the present date automobiles form an important element in the circulation of our towns. Nowhere are they more popular than in Paris; nowhere is any real progress, any fresh idea, likely to receive encouragement so much as there. Every morning the Champs Elysées, the Bois de Boulogne, and the avenues branching off from the Arc de Triomphe are alive with these horseless carriages of all kinds and traveling at a speed far surpassing that of any rival vehicle. Especially on Sundays may they be seen to best advantage in this aristocratic quarter of Paris; in fact, the number of automobilists and cyclists seems to surpass the number of the pedestrians.

No sooner had the automobile been acknowledged to be a practical thing than the bicyclists themselves were the very first to become its votaries. Naturally they were already accustomed to the dangers of the roads and thus cut out to become excellent "chauffeurs;" in fact, it was through them that the automobile was first introduced to the public.

The best known cyclists quickly mastered all the details connected with the new sport and became trainers of the aristocracy, who so eagerly took up the new sport. René de Kuyff had the Prince of Wales as his pupil, while Lambajack, the famous tandemist, gave lessons to the Duchesse d'Uzès.

But if the automobile were to remain the exclusive property of the wealthy, and of those favored by fortune, it would never obtain the popular favor without which its success would not be assured. So that the question may be asked: Can an automobile be bought nowadays in full confidence? Will not the prices lower? The fact is that those who bought machines two years ago have gained small fortunes. The best constructors not being in a position for the last two years to deliver a machine ordered in a shorter time than eighteen months after the order had been given, it may easily be understood that a machine from the same firm, bought on the spot, has a far greater marketable value. A carriage ordered at the price of nine thousand francs in eighteen months is readily sold for eighteen thousand francs, payable at the present time. So that the speculation consists in immediately ordering carriages at catalogue price and selling them the day they are delivered for some thousands of francs more than they have cost one. Hence, from a pecuniary point of view, no loss may be feared in purchasing a machine from a reputable firm; one would, indeed, be more likely to gain than to lose. An automobile, however, should not be bought without taking the advice of a disinterested specialist.

Automobiles in actual use may be divided into three classes. First, motocycles; second, carriages; third, heavy luggage vehicles.

First.—The motocycle is a cycle furnished with a mechanical motor, often supplied with ball bearings, tube frames, pneumatic tires, etc., in fact, it is more of a cycle than a carriage.

The best known is that of the firm De Dion et Bouton, the "tricycle à pétrole," which has been in existence three years. The motor is vertical and is placed in the rear, while the explosive mixture is lit by an electric spark, so that besides the petroleum apparatus a galvanic battery, etc., must be carried. The working of the driving and steering arrangement is mere child's play and can be learned in half an hour.

The great advantage of De Dion's machine is its relative cheapness and the small amount of care and attention it necessitates.

The serious defect, in the opinion of many, of the petroleum tricycle is that there is only one seat. The simplest remedy to this is to convert the simple tricycle into a tandem tricycle by lengthening the frame. This only increases the weight by 3 or 4 kilos., the only inconvenience now being that the tricycle cannot be reduced to a machine with only one seat when only one rider wishes to mount it.

The most generally adopted solution is that of the "towing-carriage," the tricycle serving as traction motor, while an iron bar is attached to the shaft of a small spring carriage with pneumatic wheels in which two persons may be seated. Average hills are readily mounted, while a slight amount of pedaling is all that is needed during a steep ascent.

This motor of the firm De Dion et Bouton has had an enormous success and has been applied in numerous ways. With it there have been provided automobile bicycles, quadricycles, and even boats.

Another vehicle, the Bolleé (see the SCIENTIFIC AMERICAN for October 17, 1890), is in the first rank of motocycles. This is a long machine, very low and stable, with two seats, the lady seated in front, the gentleman behind, steering. This is also a tricycle, but with the direction effected by the two wheels, which are in front, and the propulsion only by one in place of two. The lighting is obtained by an incandescent tube. This is a very rapid machine and a very fine hill climber. Only a few months ago, during the "Criterium des motocycles," which took place from Etampes to Chartres, a "Bollée" automobile with double motor of 8 horse power, mounted by M. Leon Bollée, the inventor, accomplished the distance of 100 kilometers in 1 hour 52 minutes, i. e., at an average pace of 51 kilometers an hour! This is the world's record for that distance for any kind of road machine whatever.

The price of motocycles is comparatively moderate and ranges between 1,000 and 3,000 francs. The fortune of the automobile certainly depends on the progress attained by this class.

Second.—The class of carriages is represented by a more considerable number of builders. Here the motors are more powerful, while the framework of the machine is as comfortable as an ordinary carriage. It is capable too of all the movements required of it if harnessed to a horse, while it may be specially noticed that a retrograde movement is possible, which cannot be said of the motocycle.

The weight of the carriages of this second class varies considerably. Generally a carriage with two seats with a motor of approximately 3 horse power weighs about 400 kilos. For four places and 6 horse power it may weigh between 700 and 800 kilos. The weight diminishes, however, day by day in proportion to the improvements in manufacture. The firm Panhard & Levassor is the most important in this class. Its principal rival is Peugeot, a firm which won the demonstration races from Paris to Rouen and Paris to Bordeaux in 1894 and 1895 respectively.

Petroleum is used by all the models in this class, though there are not lacking defenders of steam as a motive power.

M. Serpollet, the constructor of the Serpollet trams circulating in Paris, has brought out apparatus which seem as though they would finally give steam the superiority. These new types comprise very light generators, the heating of which is effected by petroleum burners, which give a flame great in proportion to the quantity of water to be converted into steam. The pressure of these burners varies between 50 grammes and 3 kilos., thus bringing into instantaneous equilibrium the effort of the motor and the resistance of the road.

The motor used on these carriages is of an entirely new system, requiring no care so far as oiling is concerned, so that steam may again speedily become a formidable rival to petroleum. The carriage is illustrated in the SCIENTIFIC AMERICAN for February 21, 1891.

Electricity, too, has made its "debut" in locomotion. An almost perfect electric motor has been found.

Backward and forward motion, and excellent brake arrangement, by the play of a simple commutator placed under the driver's hand, absence of noise, smell, or vibration, are only a few of the qualities of this wonderful motor.

It has only one fault, an immense quantity of electricity is wanted. Special accumulators, the charging of which is slow, though their emptying is rapid enough, have to be taken up. These accumulators are very heavy; 400 or 500 kilos. of them are required for a carriage in advancing 60 kilometers. Then they have to be refilled at the works. Accordingly, electric carriages can only be employed within a small radius of these works, from which the supply of energy is obtained. Still, they seem to be destined for a great future in town locomotion by reason of the ease with which accumulators may be obtained.

Third.—The third class of automobiles, public or heavyweight carriages, is necessarily restricted. They are all moved by steam. A curiosity may be mentioned, the automobile rolling house. When small, and arranged for two persons only, a petroleum motor of 12 horse power drags it along at the rate of 15 kilometers an hour. When large and containing a regular apartment for two couples and four servants, a steam motor of 35 horse power is required, though it is not safe to travel at a faster rate than 8 kilometers per hour.

Special police regulations are necessarily required, and it is found that the only regulation to-day applicable to automobile locomotion dates from 1893, at a period when the automobile, such as it appears now, was practically non-existent. According to this law, the pace ought not to exceed 8 kilometers per hour (the average speed of automobiles is 45 kilometers), the minimum for an ordinary cab.

The "chauffeur" is not permitted to leave, even for a moment, his automobile along the curb of the footpath, unless under supervision. Now, the automobile, once the motive power is turned off, cannot gallop away like a horse. To be just, a limit of speed, difficult to fix upon though it be, ought to be imposed on all kinds of mechanical carriages, as well those which now seem to enjoy a monopoly of speed as on the inoffensive automobile.

Another thorny question: Is the automobile dangerous to foot passengers? The compact mass of the iron steed rushing along at a great speed is certainly an object of dread to the passer-by. Ignorance, however, is the cause of his fear. Any automobile can be brought to a halt in two meters; a mechanical carriage of 700 kilos. possesses more rapid and powerful brakes than an omnibus with three horses, weighing 5,000 kilos.! In reality there is no mechanism more inoffensive, no means of transport more sure and safe.

This industry, which has received its birth in France and has here reached its present stage of development, is yet young. Still, even in this its youthful age, the automobile can even now render good service and give a pleasure unobtainable by any other means. If there are faults (and no one denies the fact), only time is wanted to make them disappear, and it needs no great prophet to predict that within a very few years a

© 1899 SCIENTIFIC AMERICAN, INC.

stage not far from perfection will have been reached. Meanwhile we can only keep apace with the time by studying this new device and watching its progress, which, if we do, we shall be astonished at the rapid strides being made in our midst by science in this its most attractive manifestation, appealing to the present age more from an eminently practical standpoint than from any other. A. Henry.

Paris, France.

WOODS' ELECTRIC MOTOR VEHICLES.

The art of motor vehicle construction has made such progress in the United States that one firm, the Fischer Equipment Company, of Chicago, are enabled to present twenty-nine different types of vehicles, including road wagons, runabout buggies, park buggies, park traps, brakes, stanhopes, phaetons, spiders, full mail phaetons, demi-mail phaetons, physicians' coupes, hansom cabs, victoria hansom cabs, landaus, station wagons, coach delivery wagons, hood delivery wagons, theater buses and depot buses. In fact, the company has about the same range of diversity in design that is offered by the large carriage manufacturers' catalogues of ordinary horse-drawn vehicles. The company are sole manufacturers of the "Woods' moto-vehicles," as they are pleased to term them. Elsewhere in this issue we give an illustration of a group of these vehicles as assembled before the Calumet Club, Chicago, preparatory to a run on the boulevards and avenues of that city.

The different types and characters are well set forth, and show that the art of the carriage builder has been admirably combined with the work of the electrician and the mechanician. The work of Mr. Woods on behalf of his company has been exclusively toward the production of fine artistic carriages and all the various styles and characters known to the carriage maker's trade, rather than the mere production of a self-propelling machine. The company is thoroughly well equipped for the manufacture of horseless carriages, and every part of them, with the exception of the rubber tires, is made in the factory. This insures a uniformity of workmanship and interchangeability of parts which is entirely advantageous to the purchasers.

Our engravings represent the Woods' hansom cab and a two-seated trap. The hansom cab is a particularly fine specimen of the carriage builder's art. The driver sits back of the passenger and from his seat controls the motors and steers the vehicle. So simple is the mechanism that any driver of ordinary intelligence can learn to operate it in a very short time. The cab is equipped with two motors giving 6½ horse power, that is, sufficient battery capacity to run thirty miles with one charge of batteries. There are electric lights in the side lanterns and electric lights and electric foot warmers in the interior of the body. It is designed for use on any and all streets and runs at speeds which vary from 3 to 12 miles an hour. The total weight of these cabs is 2,600 pounds. Our other engraving shows an admirable two-seated trap to accommodate four persons.

The Fischer Equipment Company are making arrangements to build a large number of Woods' electric cabs for use in the city of Chicago, and in some of the large cities they have been received with so much favor that they are filling many orders for private use, and are building a number of vehicles for European trade.

WOODS' VICTORIA HANSOM CAB.

AN UP-TO-DATE VEHICLE MADE BY FISCHER EQUIPMENT COMPANY.

The Woods' moto-vehicles are admirably designed, and one noticeable thing is that wood wheels and hard rubber tires are used almost exclusively. In practical tests of both wire wheels and pneumatic tires and wood wheels and solid rubber tires, it has been demonstrated to the satisfaction of the designer that the latter are far more desirable and endurable in many ways than the former, and present a more satisfactory appearance, and all annoyances due to punctures are done away with.

The control and operation of these vehicles has been reduced to much simplicity, so that it does not take long to acquire the skill necessary to operate them satisfactorily. One important feature is, that it is impossible to apply the brake to any of these vehicles without first cutting the power off from the motors. It is, also, impossible to apply the power without first liberating the brake. This is accomplished by an interlocking device between the brake and controller, the operation of both being effected by the manipulation of a single handle. A separate reversing switch is used which is provided with a lock, so that when the key is removed the vehicle cannot be operated by anyone not possessing a key. The various speeds are obtained by series paralleling the batteries, and in this work great pains have been taken to insure a uniformity of discharge from the batteries when in parallel; and contacts and connections of nearly four times the cross section ordinarily required are used, so that the resistance may be perfectly uniform.

In the light road buggy one motor is used with a differential gear, but in all the Woods' motor vehicles for hard and heavy work two motors are provided, one attached to either rear wheel, and every provision is made for automatic adjustment for the turning of corners or the turning of the vehicle completely around. The motors themselves are built with ironclad armatures and special coil windings, which coils are wound before being placed upon the armature. This enables the coils to be shipped anywhere, so that they can be fitted into the armature without any difficulty whatever by those who understand nothing about armature winding. The batteries may be charged while in the vehicle or duplicate sets may be substituted for them. The batteries are economical and the stated mileage capacity is conservative, and, under the proper conditions, the carriages will do 25 per cent more than their actual guaranteed figure.

The Consulting Cyclist.

The growing use of the bicycle and its frequent prescription as a means to health suggests, as a possibility, which, in fact, is already not far from its accomplishment, the evolution of a new kind of medical specialist, the consulting cyclist, who will devote himself to giving medical and practical advice as to all that concerns the use of the machine; whether to ride or not; what sort of a machine to ride; at what pace to ride; how the saddle is to be adjusted; where the handles are to be set; how the machine should be geared, etc.; all being things which differ for each individual. For, in truth, the fitting of the machine to the individual is a matter of no small nicety, and is one in regard to which the advice of a medical man knowing in such matters is of considerable importance. Many a doctor recommends the use of a cycle who is himself no cyclist, just as he may recommend hydropathic treatment, although he may know but little about the various combinations of bath treatment which will be found of greatest use at the particular spa resorted to. In stating the broad fact that cycling will do good, he is acting within the range of his own knowledge and experience; but when he is asked about speed and gears and lengths of run, unless he is a cyclist as well as a medical man, he is apt to find himself at sea, and so is tempted either to deal with these matters "on general principles" or to refer his patient to the dealer. But surely the decision as to all the details of bicycling, especially when bicycling is undertaken for health purposes, is a medical affair, and is also one which may very properly be made a specialty.—Hospital.

Bridges for Russia.

The Phœnix Bridge Company, of Phœnixville, Pa., has just received a contract for twelve steel bridges for the Russian government, and work will be commenced at once. The bridges are for the Eastern Chinese Railway, the southeastern extension of the Trans-Siberian Railroad. Work will be hastened as much as possible, in order that the material will reach its destination before winter begins. It will be shipped to St. Petersburg and thence by rail to Vladivostock. An engineer of the railway is now in Phœnixville, superintending the work.

Fall of Meteors in Indiana.

Two meteors fell at Vincennes, Indiana, on May 1. One struck a slab of stone on a Baltimore & Ohio freight car just as the train had crossed the Wabash bridge, and the slab was shattered by it. The other meteor struck a pile of brick with a loud noise and broke it into small fragments. It is doubtful if the fragments have been examined by scientific men as yet, but from newspaper accounts they appear to have been of a rocky rather than a metallic nature.

Wycliff's English Bible, usually known as the Bramhall manuscript, from the Ashburnham collection, was sold at auction for $8,750, on May 1.

© 1899 SCIENTIFIC AMERICAN, INC.

ELECTRIC MOTOR VEHICLES.

The wonderful development of electricity within the past few years, for power purposes, and its great economy, adaptability, and usefulness in that line, as shown by its universal adoption for the propulsion of street railway cars, also clearly demonstrate its superiority as a convenient and easily controlled power for motor vehicles, which are becoming so popular.

While the well known trolley car takes its power through the overhead or underground wires and conductors from an inexhaustible source of electricity, the motor vehicle is limited to the charge or amount it can carry, in consequence of the fact that it is intended to travel in places and over roads where there is no continuous outside supply of electricity. Hence, the means of storing electricity economically in the form of batteries is now one of the problems which is undergoing development.

New ideas are constantly being worked out, and it is confidently expected improvements will continue by which greater efficiency will result. At present, changes have been made in the construction of storage batteries whereby a surprisingly large quantity of active material is put into a small space, and this accounts for the neater appearance electric motor vehicles now possess over former designs. It is also a fact that the aggregate weight of battery for the amount of current discharge obtained is less than formerly.

The factor of weight is one of the features in electric vehicles that practical men are working to overcome, and it is said that whenever a storage battery or a system of storing the electric current is invented by which the weight of the battery is greatly reduced, there is certain to be an impetus given to the electric motor vehicle industry such as has never been thought of.

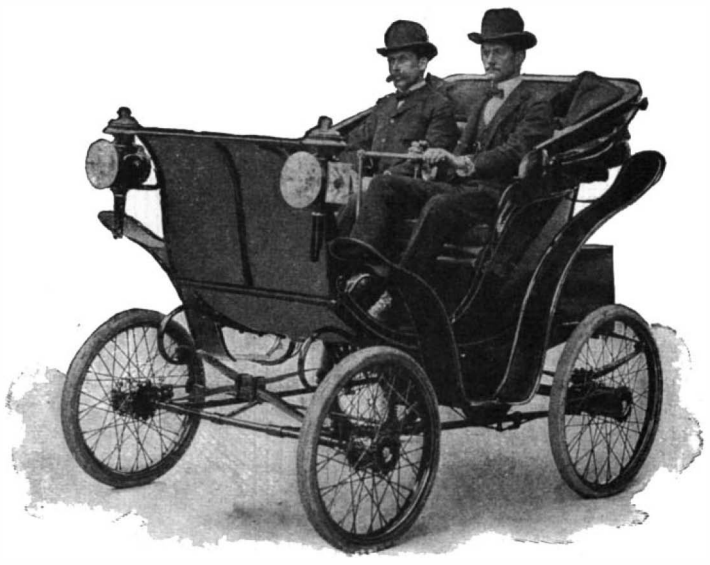
One of the essential requirements in a motor vehicle is that the reserve power shall be instantly available for a brief period of time, as, for example, when heavy grades are met with. In a storage battery this condition is perfectly met, the increase of current demanded being readily given off and accurately measured by the ampere meter, so that by observing the latter while traveling on an apparently level road one can detect slight grades by the varying position of the ampere needle.

The battery may be considered as an elastic equalizer capable of giving off in an instant the amount of current needed at various times and emergencies. This makes electricity an ideal power for vehicles, for it eliminates the complicated machinery of either gas, steam, or compressed air motors, with their attendant noise, heat, and vibration. It is not only serviceable as power, but also as light at night.

In the accompanying illustrations on the front page will be seen a new design for an electric surrey which has the appearance of an ordinary two seated carriage. The upper illustration, reproduced from a photograph, shows its appearance when on the road carrying a full load of passengers; the lower illustration gives an idea of the construction of the working parts. Referring to this, it will be seen that the storage battery is divided into two main parts, one section being in two boxes under the front seat and the other in two crates under the rear seat; access under the front seat is had by a door opening on the side, and the rear by the lowering of the hinged back of the carriage. The Willard storage cell is used, forty-four of them, the size of each is $3\frac{3}{4} \times 5\frac{9}{16} \times 9\frac{5}{8}$ inches high, and total weight nine hundred and fifty pounds. The active material is very compactly placed, yet arranged to provide a large surface. Insulated wires lead from the terminals of the battery to the controller located under the front seat just ahead of the battery, which controller is in the form of a cylinder having a number of contact plates on its surface separated by insulating material on which bear brass springs severally connected with battery in such a way that in one position of the cylinder only a few cells will operate, or in another so that they will be arranged in parallel, or in another in series, or in another for reversal of the direction of the current.

On the left hand end of the controller cylinder is a small cog wheel which meshes with a segment gear forming the lower end of the reciprocating controller lever standing in a vertical position between the cushions of the seat. The movement of this lever forward rotates the cylinder and puts on the current of varying degrees of quantity and intensity, according to the speed desired. There is a ratchet wheel adjoining the pinion of the cylinder on which a spring pawl acts as a temporary friction lock, holding the cylinder in whatever position it is placed, yet yielding to the motion of lever when forced forward or backward by the hand.

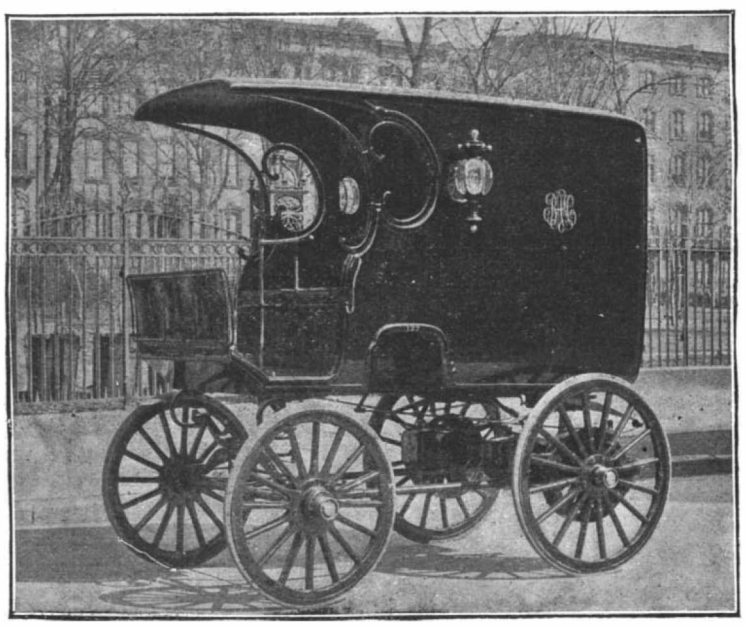
Pushing the lever forward one notch or click of the spring below gives a very slow speed of two to three miles an hour, to the second notch six to seven miles an hour, to the third notch ten to twelve miles an hour, to the fourth notch fifteen miles an hour. By drawing the lever back to the vertical position the current is thrown off. Running the length of the lever is a latch rod terminating at the upper end of the handle. To reverse the current for backing, this rod is pressed downward with the thumb at the top of the handle, which permits the controller to rotate in the opposite direction. Two different speeds for backing may be used. Thus one lever is used for a forward or backward movement. The driver sits on the left hand side of the seat, operating the driving lever with the right hand and the steering lever with the left. The steering shaft rises vertically through the bottom of the carriage, just in front of the driving lever, and is hinged so that the upper part can lie in a horizontal



AN ELECTRIC VICTORIA.

position, either to the right or the left. The driver, in the upper illustration, is in the act of operating the steering lever. An electric push button is inserted in the handle connected with a signal electric bell, seen attached to the underside of the bottom of the carriage, at the front. The signal is sounded by pressing the button with the thumb of the left hand. Under the left hand end of the front seat is a special safety switch for completely cutting off the current. At the opposite end is another switch for the electric dash lamps observed on each side. Beside this switch is a three-knife switch which is turned down for charging.

The vertical steering shaft is connected underneath the carriage by a crank and rod with one end of an interior movable hollow hub, around which the front wheel runs on ball bearings; the hub is pivoted on its interior to the carriage frame. Another connecting cross rod extends from this hub to the same style of hub on the opposite side. So that the movement of one hub by the steering shaft operates the other in the



THE RIKER ELECTRIC DELIVERY WAGON.

same direction, both moving parallel to each other. This enables the steering to be done very easily.

The carriage frame which supports the springs is built of strong steel tubing, well braced and jointed. The foot brake lever projects slightly above the floor, and has side notches for holding the lever in any position it may be placed. From this lever under the carriage, the brake rod extends to a band brake wheel secured on the rear tubular propelling shaft adjoining the large gear wheel, also keyed on the same shaft. To exclude dust, these are covered by a metal casing which is removed in the illustration for more clearly showing the driving mechanism.

An additional safety hand brake is provided, the lever of which will be seen just inside the front seat frame, and operates the usual brake-shoes which bear against the rear wheels.

The motor, of 2 kw. capacity, is inclosed in a tight metal case; one side is clamped firmly to the axle casing, the other side is loosely secured on a vertical rod, but clamped between two spiral springs inclosing the rod. The object of the spring is to compensate for the sudden thrust or strain put upon the motor when the current is quickly applied, either for going forward or backward. The pinion of the motor is made of rawhide edged with metal, and meshes into the large gear driving wheel previously mentioned. This construction makes a noiseless gear.

The rear axle is constructed in two parts. One is a solid axle attached rigidly to one rear wheel, while the other end is connected by a differential gear in hub of the other wheel with the tubular driving axle, both being incased in a stationary tubular axle and run on roller bearings. The solid and tubular axles both revolve together ordinarily, except when turning curves; then, by means of this gear, one may rotate slower or faster than the other. Such construction permits the vehicle readily to turn small circles and curves.

A later form of applying the motive power is to employ two 2 kw. electric motors, each attached to a solid rear axle and adjacent to each rear wheel. On the interior face of the wheel is a concentric toothed rack in which the motor pinion engages, thus applying the power directly to the wheel instead of to the axle. This construction will be observed in the illustration of an electric delivery wagon, and it will be noted that the wheels are of wood, fitted with solid rubber tires. The battery in this vehicle occupies the floor space in the bottom and rises nearly level with the driver's seat. In other respects the controller and brake mechanism is the same. The weight of this vehicle is 3,600 pounds. It is extremely convenient to operate in crowded streets, and is more economical to run than a horse vehicle. With one charge of the battery the vehicle is capable of running 30 miles on a smooth, hard pavement.

In another illustration will be seen a single-seated victoria rich and handsome in appearance. In the piano-like extension on the rear is the battery. The vehicle has pneumatic rubber tires and is operated on the same plan as the others. It weighs 1,800 pounds and has run a total of nearly 5,000 miles.

Electric vehicles are provided with a special socket under the floor, in which a brass plug fits for charging and making connection readily with the source of electricity.

The charging of the storage battery occupies on the average about two hours' time, the quantity of current being varied to suit the rise of the voltage.

It should be mentioned that the weight of the electric surrey is 2,700 pounds and that it travels a distance of 25 miles on a level road on one charge. It has a combination ammeter and voltmeter on the dashboard in front of the driver, and thick pneumatic rubber tires blown to a pressure of 125 lbs. to the square inch. The wheels are about three feet in diameter. Adjoining the light switch on the left is a three-knife switch, which is turned down when the carriage is charged.

All of the foregoing described motor vehicles were designed and manufactured by the Riker Electric Motor Company, Nos. 45 and 47 York Street, Brooklyn, N. Y., on what is known as the "Riker system," after the patents of Mr. A. L. Riker, a well known mechanical and electrical engineer. The company has recently introduced another type, the "brougham," a very serviceable vehicle, and have supplied customers in France and England with their vehicles. Several of these vehicles are to be seen at the Electrical Show at Madison Square Garden.

Relief Expedition for Lieut. Peary.

The sealing steamer "Hope" is to be thoroughly overhauled and repaired preparatory to proceeding northward next month with an expedition for the relief of Lieut. Peary, who went to the Arctic regions last summer with a specially selected party. It is thought that he may now need assistance, as his steamer, the "Windward," has been frozen in the ice floes since the early part of last winter.

More Locomotives for England.

According to recent cable advices, it is stated that the Midland Railway of England has arranged to place another contract for 130 locomotives with American firms. It is understood that the Great Northern Railway will also order a large number of engines of the mogul type from American locomotive builders.

THIEVES have taken nearly all the brass work of the Yerkes electric fountain in Lincoln Park, Chicago, and, of course, in taking the brass fittings, they did great damage to other parts of the fountain.

© 1899 SCIENTIFIC AMERICAN, INC.

SOME EARLY FORMS OF THE AUTOMOBILE.

The great interest and activity which have been shown during the present decade in the question of automobilism, and the fact that early in the previous decade such a thing as a practical automobile did not exist, would lead one to suppose that this was an entirely modern method of locomotion—an attempt, in fact, to extend the autotractive principles of the locomotive to our city streets and country highways. As a matter of fact, however, the automobile antedates the locomotive. The rude steam carriage of Cugnot was built over half a century before the locomotive, and a practical steam coach was carrying people on the roads several years before the railway was an assured success. Indeed, some excellently designed and successful steam coaches were in operation and running on a regular schedule during the early years of the steam railway, and had it not been for the sudden diversion of public interest and capital from road traction to rail traction, we would not at this late day be working on the problem of the best forms of body, frames, and motor for locomotion on the roads.

Unquestionably, the credit of having designed and constructed the first mechanical road carriage belongs to a Frenchman, Nicolas Joseph Cugnot, who built and ran in 1763 a successful model, and subsequently, in 1769, constructed for the French government a three-wheeled steam gun-carriage for transporting heavy ordnance. The well known illustrations of this carriage show it to have been a very crude affair. It was carried upon three wheels; the gun resting between the larger wheels, and the boiler and engines being placed so as to overhang the trolley. This single wheel was both driving and steering wheel in one, and it turned about a king-pin, the vertical engines being so mounted as to permit this rotation. The boiler was a kettle-shaped affair, with a fire-box formed in its base, and a steam pipe which led from the dome-shaped top to a two-way valve, communicating with a pair of vertical bronze cylinders. The rotary motion was secured by means of pawls on the piston rods and ratchet wheels fixed to the driving wheel. Crude as Cugnot's machine was, he deserves every credit as the pioneer builder of an automobile carriage.

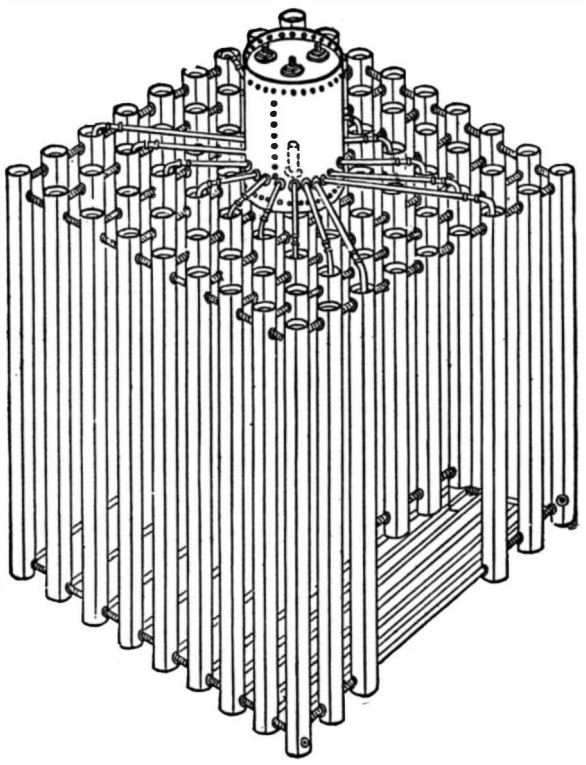
For the next practical carriage we must cross to England, where Murdoch, in 1781, built and ran a model steam tricycle which is now preserved in the Birmingham Museum. William Symington, whose name is closely associated with the early development of the steamship, turned his attention to steam road carriages, and in 1786 built a road coach in which the movements of two pistons were communicated to the driving wheels by racks and pinions.

In America the name of Oliver Evans is honorably associated with the history of the steam carriage. In 1786 he applied to the Legislatures of Pennsylvania and Maryland for a patent on steam wagons, and began the construction of one, although later he neglected it for other pressing and more profitable enterprises. About this time, however, he moved an engine from the factory, where it was made, to its final position by placing it on wheels and gearing the wheels to the crankshaft. Nathan Read, in 1790, applied for a patent on a steam carriage and constructed a model. He proposed to use two double acting steam engines, and his design is specially meritorious because he made use of his multitubular boiler—an indispensable element to the complete success of steam-driven carriages.

In tracing the growth of the automobile we must again cross to England and take note of the work of Trevithick, the man who, perhaps, more than all others, is entitled to be called the Father of the Locomotive. During the closing years of the eighteenth century be built several models, and in 1801 he built a full sized road coach which had its trial on Christmas eve of that year. A quaint account of the trip by an eye witness and participant will bear repetition: "In the year 1801, upon Christmas Eve, towards evening, Captain Dick (Trevithick) got up steam. . . . When we see'd that Captain Dick was a-going to turn on steam, we jumped up, as many as could—maybe seven or eight of us. 'Twas a stiffish hill going from the Weith up to Comborne beacon, but she went up like a little bird. . . . As we were very squeezed together, I jumped off. She was going faster than I could walk, and went on up the hill a quarter of a mile further." Pretty good work for a trial trip, up hill, with an overload of passengers, and in the year 1801!

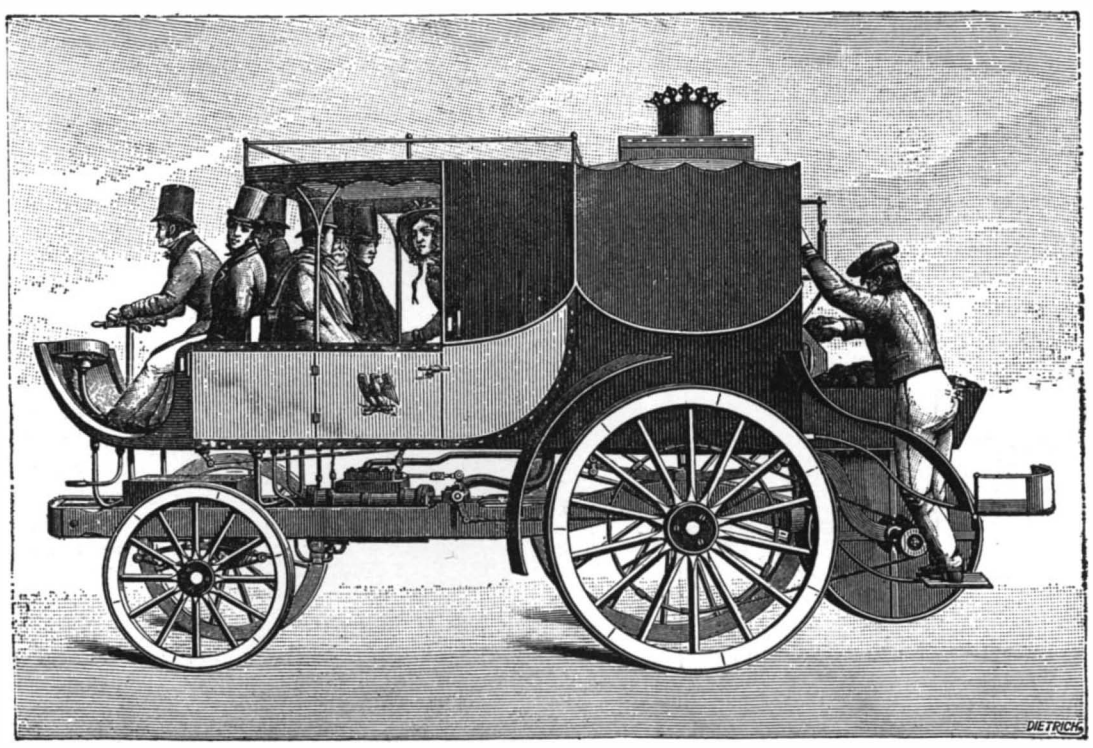
Trevithick, like many a pioneer inventor before and since, grew disgusted with the opposition or apathy of the public and turned his genius in other directions. He was succeeded by less talented and practical men, who, fearful that they could not secure sufficient adhesion, built rack railways, or attempted, like Brunton in 1813, to imitate the action of a horse's legs, and actually built machines that were prodded along by jointed iron legs that pushed against the ground.

The first attempt to place on the roads a mechanically propelled stage coach was made by W. James, assisted by Sir James Anderson. The illustrations show this very ambitious vehicle, which was capable of carrying twenty people, to have been modeled on the lines of the horse drawn stage coach. It was driven by a pair of two-cylinder engines, and it proved its carrying ability when, on the failure of one of the engines, it made the homeward trip from Epping Forest to London at seven miles an hour with a full load of passengers.



MACERONE AND SQUIRE'S WATER-TUBE BOILER. PRESSURE 150 POUNDS.

In 1822 Sir Goldsworthy Gurney, a man of high scientific attainments, took up the steam-carriage problem and placed several steam coaches on the highroads. He succeeded in climbing the steepest hills in and around London, and only gave up his attempts when the opposition of vested interests rendered them unprofitable. At the same period Hancock was achieving remarkable success in the construction of large steam omnibuses, of which he built nine in all.



THE MACERONE AND SQUIRE STEAM CARRIAGE, 1833.

Cylinders, 7½ inches by 15¾ inches; water-tube boiler, forced draught, and 150 pounds steam pressure; average speed, 14 miles an hour.

Upon the retirement of Gurney, one of his employes, J. Squire by name, constructed a steam carriage. Assisted by Col. Macerone, he subsequently built several practical carriages, one of which is shown in the accompanying illustration. It will be seen that it was a four-wheeled affair, with the passenger accommodation in front and the boiler behind. The latter was of the vertical, water-tube type (see cut) with a central steam receiver, and carried a working pressure of 150 pounds! Think of that! A pressure which engineers in most other lines of mechanical development did not venture to use until half a century later. The engines were mounted between the frames and connected to cranks on the rear axle. The cylinders were 7½ inches diameter by 15¾ inches stroke. The furnace, which was practically self-fed, was fed from a hopper, and forced draught was secured by means of a fan, driven by belting from a pulley on one of the rear wheels. This coach ran 1,700 miles without repairs. It used coke for fuel, at a cost of about seven cents per mile, and its average speed was 14 miles an hour.

It is beyond the scope of this article to pursue the subject further or speak of the labors of such men as Benstall and Hill, Anderson and James, Heaton, Church, and the great Scott-Russell, builder of the "Great Eastern," and others less known; but enough has been said to prove that the present activity in automobilism is merely a revival of an industry which, over sixty years ago, had advanced to a high stage of perfection, and but for the success of the railroad and the bitter opposition of the stage coach and other vested interests, would undoubtedly have kept pace in its own sphere of usefulness with the steam railroad. The attempt to establish the steam carriage on a permanent footing failed, and, except for occasional and widely separated attempts to improve on the early forms, nothing was done for a period of half a century. The next serious attempt to develop the automobile was to take place in the country of the pioneer builder of these machines, for to France belongs the credit for the modern revival of the mechanical road carriage. A condensed history of automobilism in Paris (which is France) will be found in another column.

A Novel Path for Bicyclists.

The lot of the wheelman is not a particularly happy one in the mountainous region about Los Angeles and Pasadena, in Southern California, for cycle paths are unknown, and beyond the city limits the country is so rolling that the pleasures of cycling are not commensurate with the pains. All this is to be changed, however, by the construction of an elaborate wheelway which is probably unique.

An elevated cycle path is to be erected between the two places, which will be nine miles long. It will be remembered that Pasadena and Los Angeles are sister cities, and the problem of transportation between them has been slow of solution, owing to the fact that the country between the two places is of such a rolling character, and also on account of the numerous waterways, or "arroyos secos," as they are called. The cities are now connected by three railroads and one electric road. There was, however, no foot road for cyclists. The common wagon roads, with their dust and mud and ruts, had to be followed, which made cycling anything but pleasant. In spite of these drawbacks, there was a certain amount of bicycle riding between the two cities, and in the face of discouraging circumstances, it was found that there were at least 30,000 wheelmen in Los Angeles County alone. In view of these facts, Mr. Horace M. Dobbins, of Pasadena, organized what is known as the "California Cycleway Company." The capital was quickly forthcoming, and plans were drawn for an elevated speedway between the sister cities, which is to be exclusively devoted to cyclists. The franchise and rights of way have now been obtained and the work has actually begun.

The path is supported by pillars of varying heights to take up the inequalities in grade. The floor is of boards and is 10 feet wide. There is a 4-foot lattice work fence on each side, to protect the cyclists. The pathway will be lighted by electric lights, staggered across at intervals, as on the Brooklyn Bridge. Midway between the two cities a park and casino will be built by the company. The charge for the use of the structure will be merely nominal, and annual passes will be issued with each share of stock. Special attention has been paid to the grades, and the trip northward to Pasadena from Los Angeles will be no hardship, as the grade is almost imperceptible. Cyclists will now be permitted to view the beautiful scenery without having to look out for ruts in the road.

M. Muzin, who obtained much valuable information about the Congo region by his journey to the center of Africa, made from 1889 to 1892, died at Zanzibar.

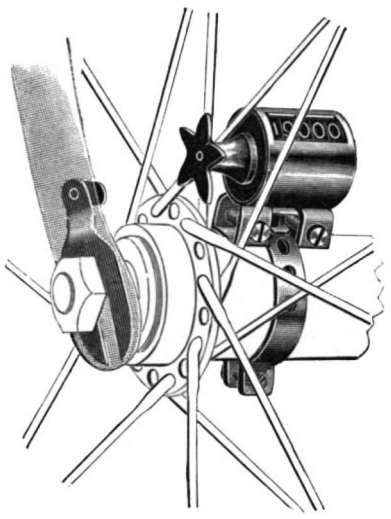
© 1899 SCIENTIFIC AMERICAN, INC.

NEW METHOD OF MOUNTING CYCLOMETERS.

One of the causes which has led to many riders discarding their cyclometers, much against their inclination, is the fact that they are easily broken off when the wheel is put into a rack or stacked up with others, or become bent so that the trip does not engage and the record is lost.

Having in mind these objectionable features of the cyclometer in general, the New Departure Bell Company have introduced the cyclometer shown in the accompanying illustration.

The cyclometer proper is mounted inside of the spokes and upon the hub, the star wheel projecting just through the spokes, but not far enough to catch or hit anything. The trip is mounted on the axle inside of and behind the fork, thus being entirely out of the way. In the illustration the bicycle fork is made transparent, so that the trip may be seen.



NEW METHOD OF MOUNTING CYCLOMETERS.

It will be noted that this construction at once removes all source of danger to the cyclometer and affords the rider the means of keeping his mileage correctly without danger from breaking or mischievous handling.

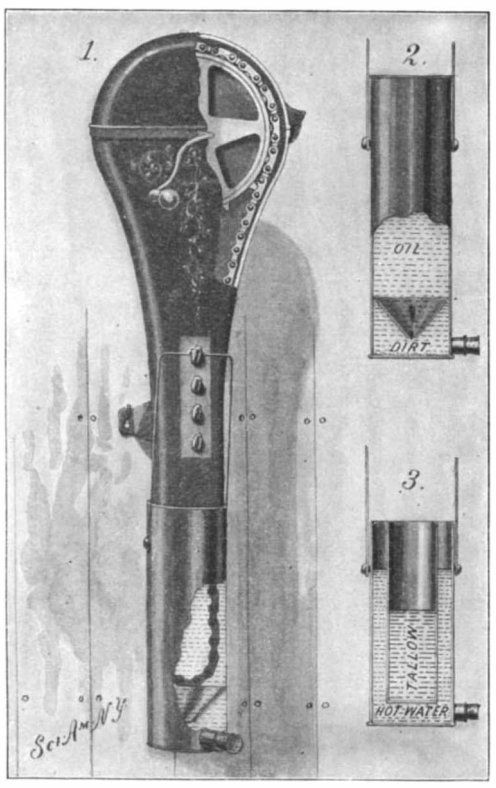
Every gear of this cyclometer is machine-made and finished accurately to gage. No soft metals or cast parts are used. None but the best hard brass and special nickel silver enters into its manufacture.

A MECHANICAL BICYCLE-CHAIN CLEANER.

The ordinary method of cleaning a bicycle chain by means of kerosene has its disadvantages, chief among which may be mentioned the lack of any means for "filling" the chain after having been cleaned, so that no dirt shall enter the joints. A mechanical chain cleaner, made by the American Bicycle-Chain Cleaner Company, 106–108 Beekman Street, New York city, provides a means whereby the links can be properly "filled" and lubricated after having been cleaned.

The chain cleaner in question comprises a receptacle having a hinged cover, two cups which can be attached to the receptacle, and a sprocket wheel mounted in the upper part of the receptacle and operated by a crank.

Of the two cups, one is designed to contain kerosene and the other tallow. The kerosene cup is provided with a false bottom having a hole through which the



A MECHANICAL BICYCLE CHAIN CLEANER.

dirt gravitating from the chain may pass. The tallow cup is provided with an outer and an inner compartment. Within the inner compartment tallow is placed, which is melted by hot water poured into the outer compartment.

The chain, after having been removed from the bicycle, is hung upon the sprocket wheel in the upper part of the receptacle. The kerosene cup is then hung in place, so that the lower portion of the chain is immersed in the oil. By rotating the sprocket wheel rapidly, the dirt will be removed from the chain and will gravitate through the false bottom of the cup. When the chain has been cleaned, the kerosene cup is removed, and the tallow cup substituted therefor. The sprocket is then turned again to "fill" and lubricate the chain. After having been removed from the hot tallow the chain is hung up to cool.

Thus "filled," the chain is protected against the admission of dirt by a coat of tallow which remains in the joints for a considerable time.

The manufacturers have subjected their device to severe tests. Seventeen links of a chain became eighteen inches long after three thousand miles had been ridden without cleaning, graphite and oil being used to lubricate the links; while seventeen links became only seventeen and three-sixteenths inches long after a ride of fifteen hundred miles, when the chain cleaner had been used.

Bicycles for Firemen.

Radical changes are being made in the fire system of Washington, D. C. The most important is, without doubt, the mounting of firemen on bicycles. Commissioner Wight, noting the success which has attended the formation of police bicycle squads, decided to also mount a certain number of firemen on bicycles. At each engine house a fireman was selected to ride a bicycle. Whenever his company is called out he precedes it to the fire. A man mounted on a bicycle can make much better time over the perfect asphalt streets of Washington than a heavy fire engine drawn by horses. Every second is important in a fire, and in many cases, when lamps are overturned or draperies catch fire, the presence of an experienced man with the necessary appliances might prevent disastrous fires by attacking the blaze in its incipient stage. It is estimated that firemen on bicycles are able to reach the fire on an average of three minutes before the apparatus, and where four or five companies respond to a fire an equal number of trained men would be at the point of danger at about the same time, and might often accomplish a great deal before the engine and ladder companies arrive. Each bicycle fireman will carry a small chemical fire extinguisher upon his back, and he may also carry a light pick.

Among the other innovations which have been introduced is the use of a megaphone for giving orders, taking the place of the old firemen's trumpet. Since these novel features have been introduced the Commissioner has received many sensible suggestions, one of them being for a chemical fire extinguisher of considerable size to be carried on a duplex bicycle propelled by two men. Such an arrangement could also carry a scaling ladder and picks. An automobile chemical fire extinguisher and ladder cart would be particularly desirable in either city or country, especially in the latter, where horses are not readily obtainable at the moment of a fire. No town is so poor that it could not afford at least one piece of automobile fire apparatus. It would be ready at a moment's notice to go immediately to the scene of danger, would cost nothing for maintenance, and, with proper inspection, there would be no danger of its giving out at a critical time. Other suggestions for improvements in fire fighting is a small telephone outfit to be carried on the backs of firemen. As the fireman dashes into the building the wire could be unwound automatically from the reel, and he could readily communicate with the chief on the ground, so that if there were any danger of a wall or floor falling, the firemen could be notified. Of course, it might be said that the wires would be injured by the fire itself, but there are many occasions on which firemen do most of their work from adjacent buildings, where there would be no danger of the wire being destroyed or even of the insulation being burnt off.

A NOVEL STIRRUP-PEDAL FOR BICYCLES.

A stirrup for bicycles has been patented by Carl F. Kabisch and Raphael B. Garcia, 95 Broad Street, New York city, which is designed to enable a rider to exert greater power on the downstroke than would be possible if the ordinary form of pedal were employed, and to obtain a better control of the wheel when back-pedaling.

The stirrup is pivoted on the pedal-pin of the crank by means of a sleeve swinging on ball-bearings. Whatever may be the position of the crank, the stirrup will always hang vertically.

The foot on the downstroke exerts force upon the bottom of the stirrup, and on the upstroke the foot will bear against the pedal-sleeve. Power is therefore applied on both up and down strokes. It is claimed for the stirrup that it dispenses with the necessity of toe-clips; that high knee-action is overcome; and that in back-pedaling the rider is enabled to stop his wheel more quickly than would otherwise be possible. From Fig. 1 it is evident that the crank can be made shorter than usual, because the stirrup-pedal being always in vertical position, the length of the upstroke is that of the crank and the length of the downstroke that of the crank plus the depth of the stirrup. It follows, therefore, that the path of the foot is elliptical, thus enabling the rider, as before mentioned, to apply more power than would otherwise be possible.

A SIMPLE BICYCLE-SUPPORT.

The subject of the accompanying illustration is a bicycle support, so constructed that, when not in use, it may be folded closely against the bicycle-frame.

Fig. 1 is a view of a bicycle with the support attached. Fig. 2 represents the lower brace of a bicycle with the support in closed position.

The support comprises a tube in which a rod telescopes. The tube has a longitudinal slot with offset slots at the ends in which a pin on the rod is capable of engaging. When the pin is in the lower offset slot, the parts are held rigidly in supporting position. When the support is folded against the frame, the pin is

WARD'S BICYCLE-SUPPORT.

turned into the upper offset slot to prevent an accidental outward movement of the rod.

The support is pivoted to the bicycle by means of a yoke on the tube, which yoke embraces the bicycle-frame and enables the support to be swung out of operative position.

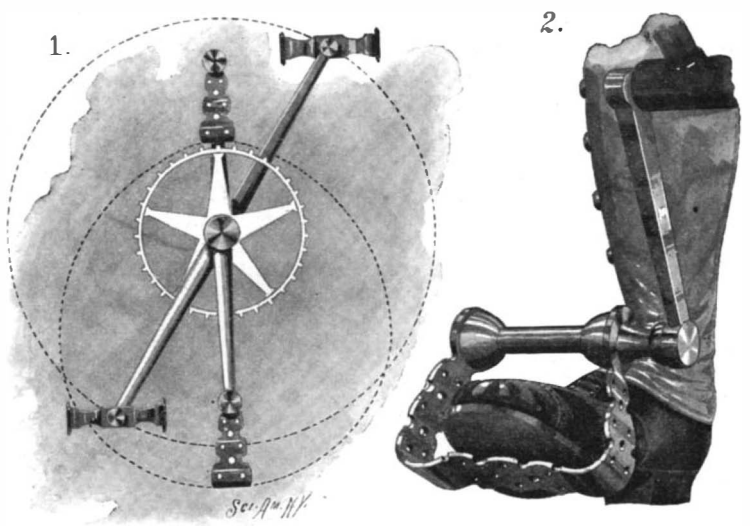
To the forward part of the lower brace a second yoke is pivoted, which serves the purpose of preventing the turning of the front wheel. This yoke is so connected by means of a wire with the support-tube that, when the support is swung into operative position, the yoke will be made to embrace the front wheel, and, when the support is folded up against the lower brace, the yoke will be swung out of engagement with the front wheel.

In order to hold the support against the frame, spring-clips attached to the lower brace are employed.

The inventor of the device is Frank J. Ward, of Fitchburg, Mass.

Arrival of the "Somers."

The torpedo boat "Somers" arrived in New York on May 2, on the Atlantic Transport Line steamship "Manhattan." We have already referred to a large number of accidents which have occurred to the "Somers." She will be taken to the Brooklyn navy yard, where an attempt will be made to put her in an effective condition. The "Somers" has a single screw and is 156 feet long; her beam is 17 feet 6 inches and she draws 4 feet 6 inches of water; she registers 145 tons and has two smokestacks, a conning-tower, and one torpedo tube; she mounts no guns.

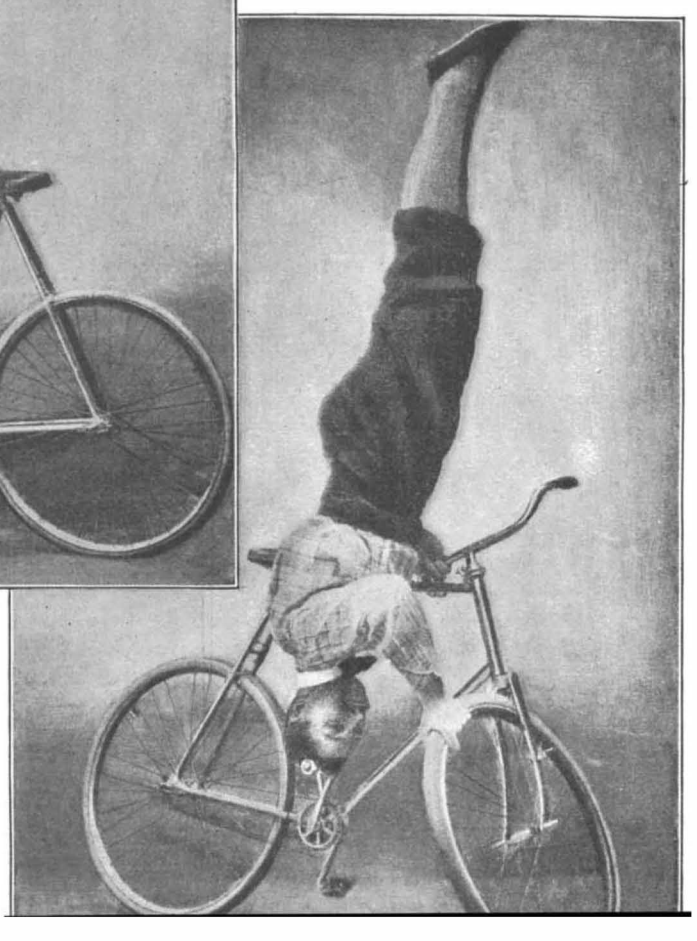


A NOVEL STIRRUP PEDAL FOR BICYCLES.

© 1899 SCIENTIFIC AMERICAN, INC.

THE DARING FEATS OF A TRICK-RIDER.

The habitués of the Variété Battenberg, in Leipsic, recently had an opportunity of witnessing the astonishing feats of an American trick-rider, N. C. Kaufman, whose performances probably surpass anything which has yet been attempted in Europe.



Our German contemporary, Die Illustrirte Zeitung, remarks that Kaufman's tricks are so startling and often so daring that a description of them would fill a goodly sized volume. When Kaufman first appears upon the stage, he lays his wheel upon the floor. He then runs up to it, and in a flash, placing both feet upon the pedals, swings himself into the saddle. Then a series of remarkable tricks rapidly succeed one another. He stands upon the step and drives the bicycle with his hands. He seats himself in the frame and, guiding the wheel with one hand and turning the pedal-crank with the other, rides at full speed about the stage. Then, unwinding himself from his uncomfortable position, he swings himself into the saddle again, and, raising the front wheel at the same time, turning the handle bars completely around, pedals about supported only by the rear wheel.

While riding in this way he performs all conceivable acrobatic feats. One of our illustrations, for example, shows him standing upon his head—a feat which requires the utmost firmness and coolness. He confines himself not to the safety alone, but also performs his tricks on the old-fashioned "ordinary," exhibiting many new feats in addition to the conventional tricks of most trick-riders. In spite of the many break-neck experiments which he has made, he has never been seriously injured, although accidents have occurred. Kaufman was born in Rochester, and first came into notice at a race given by the Rochester Bicycle Club. At the present time he is probably the best-known of all trick-riders.

THE HISTORY OF THE BICYCLE.

The history of the bicycle has been written so many times that it is undoubtedly an old story to many of our readers, still, for the sake of those who may not be familiar with it, we give the following brief outline. The now historic types in the evolution of the modern bicycle are so well known that we have refrained from reproducing illustrations of them.

The germ of the modern bicycle is found in the "hobby-horse" which was popular at the beginning of the present century. In brief, it consisted of two wheels connected by a rigid frame of wood; the rider sat on a saddle midway between the wheels and propelled it by means of strides on the ground. No provision for steering was made, so that its motion was limited to a straight line. In 1818 Baron Von Drais arranged this cumbersome machine so that the front wheel could be steered. That such a clumsy means of locomotion should soon fall into disuse was not at all strange. We have now had two wheels arranged in tandem, then the steering head was invented which permitted one of the wheels to turn, and finally the third step consisted in contriving a mechanism by which the affair could be propelled without touching the feet to the ground. Such a machine is credited to two Scotchmen, Gavan Dalzell and a man of the name of MacMillan. It was usually supposed that Dalzell's invention dated from 1834, but in 1892 a close examination of the matter resulted in the downfall of the legend, and even the original blacksmith's bill was found, which proved that it was made in 1847. In Dalzell's device there were no true pedals in the ordinary sense of the word, the feet describing only a small segment of a circle. The motion was transmitted to a crank attached to the axle of the rear wheel by a lever.

It was to Ernest Michaux, a young Frenchman, that we are indebted for the fourth great step in the development of the bicycle. In 1855, while repairing one of the old machines invented by Baron Von Drais, he conceived the idea of applying cranks directly to the front wheel. The Michaux bicycle, or "velocipede," as it was called, soon attained great popularity, and the early types of this machine, or "bone shaker," have undoubtedly been ridden by some of our readers. Bicycle academies were established and races were run, and the machines even penetrated the far East. In 1869 a Parisian, M. Magee, still further improved the velocipede by making it entirely of iron and steel. And in the same year rubber tires were introduced. In 1869 M. Michaux conceived the idea of making the front or drive wheel larger than the rear wheel, and brakes were also introduced. The result of the constant improvement was the old so-called "ordinary" or "spider" wheel, which remained very popular for the next fifteen years. The new wheel weighed from 35 to 50 pounds, instead of 80 to 100 pounds of the old velocipede. There were many dangers connected with the high wheel, however, and various expedients were adopted to avoid the danger of falls, such as placing the small wheel in front and propelling the machine by levers, straps, and ratchets. In 1880 Starley introduced what was called the "Rover," which was the true prototype of the modern safety. The wheels were both low, the larger one being in front. The rear wheel was driven by chains and sprockets, the same as in the wheel of to-day. Little by little, changes occurred in the frame and great improvements were made in construction. Complex shapes which were once thought impossible to produce are now forged and brazed together. The strength of materials used in bicycles has been studied with great care, and the result has been that it is entirely possible to make a thoroughly satisfactory wheel which will weigh 22 pounds. At first manufacturers built the frames on dissimilar lines. Every manufacturer had a model of his own. Soon the frames of the wheels began to have a general resemblance, and at last the almost straight line pentagonal diamond was adopted. Gradually the top bar of this frame was raised, until to-day it is parallel with the ground. In its frame the bicycle is a veritable mechanical and engineering achievement. The bearings received more and more attention, until now a wheel will travel thousands of miles without showing any appreciable wear to them. In the old velocipedes the frame was rigid; then springs were introduced, the cushion tire followed, and finally the pneumatic tire was resurrected from the old patent records, thus furnishing the ideal spring between the rider and the ground, minimizing the jar due to inequalities of the road and giving a maximum of ease and comfort to the rider. By such steps was the simple diamond frame wheel evolved from a construction which was almost a mechanical impossibility. The mechanical difficulties connected with the tricycle are less than those connected with the bicycle, but tricycles have never been particularly popular, even when built on the lines of the modern bicycle. Perhaps the greatest field for the tricycle is where it is propelled by a motor, and in the present issue we illustrate the leading French motor tricycle.

There have been a number of special forms of bicycles on the market, of which the chainless wheel is perhaps the most interesting and important. The chainless bicycle does away with the dust and friction of the chain, the shaft being substituted. Many riders claim that the chainless wheel runs steadier than the chain-driven wheel. Various devices, some of them highly successful, have been used instead of bevel gears. Most manufacturers of chainless bicycles still continue the manufacture of chain-driven wheels. The tandem is also one of the best examples of the special form of bicycle, and, strange to say, it goes back to 1869, when the device was invented which made it possible for two people to ride on a velocipede, the back saddle being intended to be used either as a side saddle for a woman or as a man's saddle. The advantages connected with a tandem are many. Geared up to high speed, a tandem runs with great ease, and the two riders are able to carry on conversation. The absence of vibration and the power which the tandem has against a head wind have all conduced to make it popular. Gradually came the demand for higher and higher speed for pacing and racing purposes; so we now have six or even seven riders mounted on a single pair of wheels. The sextuplet wheel really represents a remarkable engineering achievement, as the truss which is formed may have to support a thousand pounds. Such a wheel is

THE DARING FEATS OF A TRICK-RIDER.

© 1899 SCIENTIFIC AMERICAN, INC.

geared to 153, so that every revolution of the pedals carries the wheel 38¼ feet.

Ladies' wheels early attracted attention after the safety was in use, and to-day lady riders are numbered by hundreds of thousands. The lady's wheel presented a more difficult problem than the ordinary bicycle, as the diamond frame was necessarily abandoned, but a lady's wheel is now produced which is equal to a man's wheel, with a slight increase of weight. The first drop frame, or lady's machine, was patented in the United States in 1887.

THE ART OF TRICK RIDING.

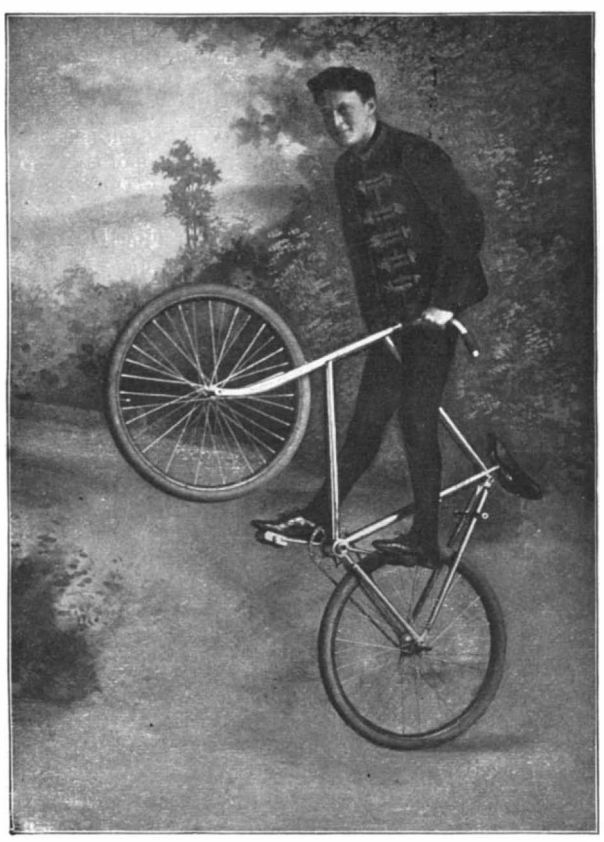
There are few regular attendants at bicycle races and bicycle tournaments who have not witnessed the remarkable performances of some trick bicycle riders, and trick riding has also proved very popular on the vaudeville stage. No one but an experienced cyclist can fully appreciate how expert a rider must be in order to perform even the simplest bicycle riding act. It gives us great pleasure to present some illustrations of remarkable feats performed by Lee Richardson, the representative fancy bicyclist of this country. Lee Richardson is the son of Mr. L. M. Richardson, of the Monarch Cycle Manufacturing Company. Lee Richardson was born in Milwaukee, Wis., and attained his wonderful proficiency by most careful study and practice. He considers that one of the important points in trick riding is to ascertain the limit to which one can safely go in the manipulation of his machine in the execution of fancy evolutions. It is, of course, essential for the rider to know every peculiarity of his wheel, and the possibilities and contingencies which have to be guarded against. Unlimited patience and exhausting practice are necessary to become a trick rider. Grace and ease are required by all trick riders, but this all comes in time. Considered from a scientific standpoint, fancy bicycle riding brings every muscle in the body into play, and even practice in the simpler maneuvers will, in a short time, give increased strength and skill, and in a very little time muscles will begin to develop of whose existence the rider was practically ignorant.

Riding on Dismembered Bicycle.

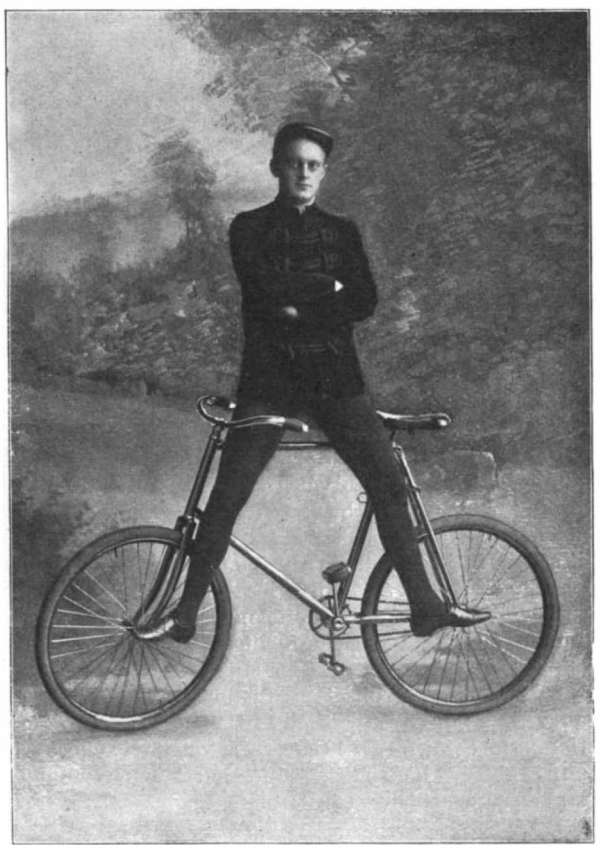
The bicycles of trick and fancy riders are specially constructed, for they require to be built additionally strong, as the regular light wheel will not stand the great strain to which the trick wheel is subjected. Such wheels vary in weight from twenty-eight to thirty pounds. The wheels are usually of a diameter of twenty-six instead of twenty-eight inches, and the frame is well reinforced. The front fork is arranged so as to permit of the front wheel making a complete revolution without coming into contact with the lower tube of the diamond frame.

The wheel ridden by Mr. Richardson is fitted with changeable gear, which permits of his going from the saddle through the frame and remount the saddle again while the machine is in motion—a trick which cannot be performed without the device mentioned.

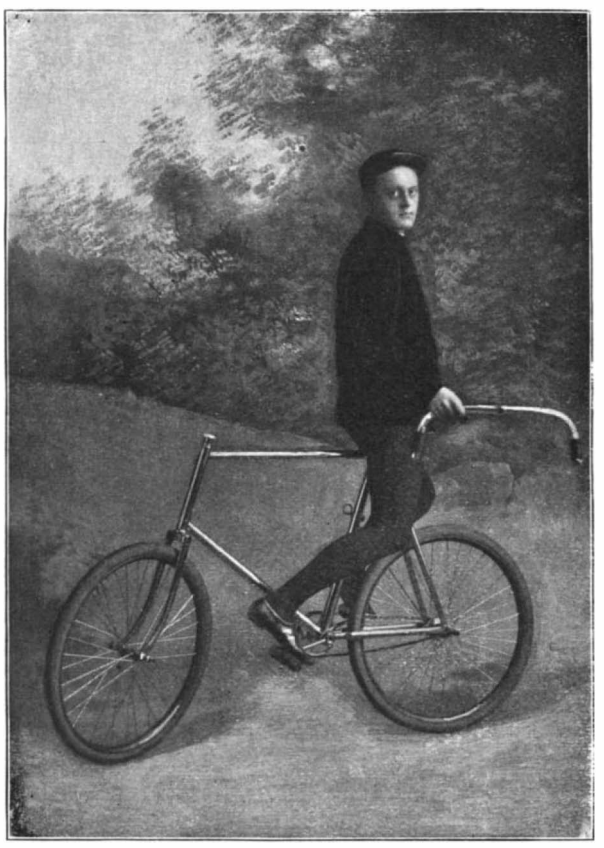
The simplest trick riding is to learn to ride on the machine without keeping the hands on the handle-bar. This is practiced by thousands of riders who never think of performing any tricks. Then follow side-saddle movements and various kinds of standstills. After the rider has become proficient in these comparatively simple tricks, it is possible to make trials of harder ones. One of the most difficult of fancy riding tricks was originated by Mr. Richardson; this is the riding of the machine backward while seated in the saddle in the regular way. This trick requires weeks of hard work before any success can be obtained. Mr. Richardson is to have an eight weeks' season in London.



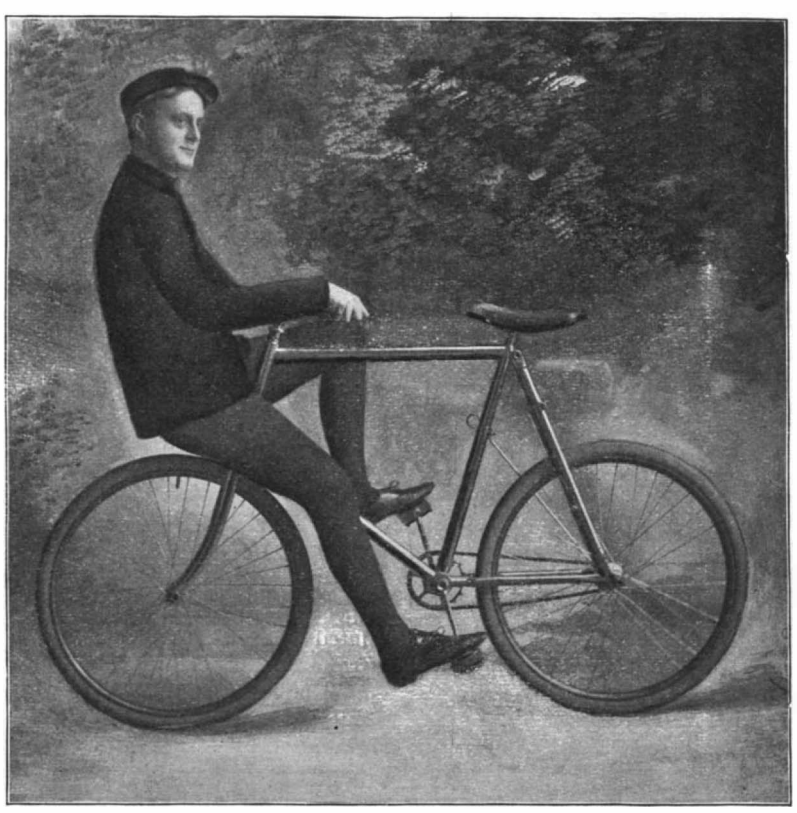
Riding on the Rear Wheel.



Maintaining Equilibrium Under Difficulties.



Riding Without a Handle Bar.



A Difficult Feat.

Driving the Wheel by Hand.

THE ART OF TRICK RIDING.

© 1899 SCIENTIFIC AMERICAN, INC.

EARLY FORMS OF LETTERS PATENT.

The forms which letters patent for inventions have taken at different stages in the history of this country are various and interesting. In colonial times their form was that of a grant directly from the legislative bodies. There were no general patent laws, but a separate act was passed for each patent, and each act was conditioned to fit the merits of the particular invention which it was to protect. These acts usually recited that, whereas the petitioner had made a certain invention which was esteemed to be valuable; it was, therefore, enacted that he should have certain exclusive rights in the invention for a specified time and under certain conditions.

The earliest patents contained no description of the invention except its title, and the identity of the invention had to be established by extraneous evidence. Some of the later colonial patents contained quite complete statements of the object and mode of operation of the invention, but there was no detailed description of the invention. The first patent to contain a specification was granted in 1712 to John Nasmyth.

The term of the grant varied according to the importance of the invention, but was usually fourteen years, in conformity to the British system. Conditions were frequently attached to the grant. For instance, the General Court, or legislature, of the Massachusetts Bay Colony in 1646 granted a patent to Joseph Jenkes for "manufactures of engines of mills to go by water for speedy dispatch of much work with few hands," enacted that "no other person should set up or use any such new invention or trade for fourteen years," and imposed the conditions that the court should have power "to restrain the exportation of such manufactures and the prices of them to moderation if so required."

Patents granted under all the various patent laws of the United States have had the caption "The United States of America," followed by the phrase "To all to whom these presents shall come," and have closed with the usual attestation: "In testimony whereof I have hereunto set my hand and caused the seal —— to be affixed," etc.

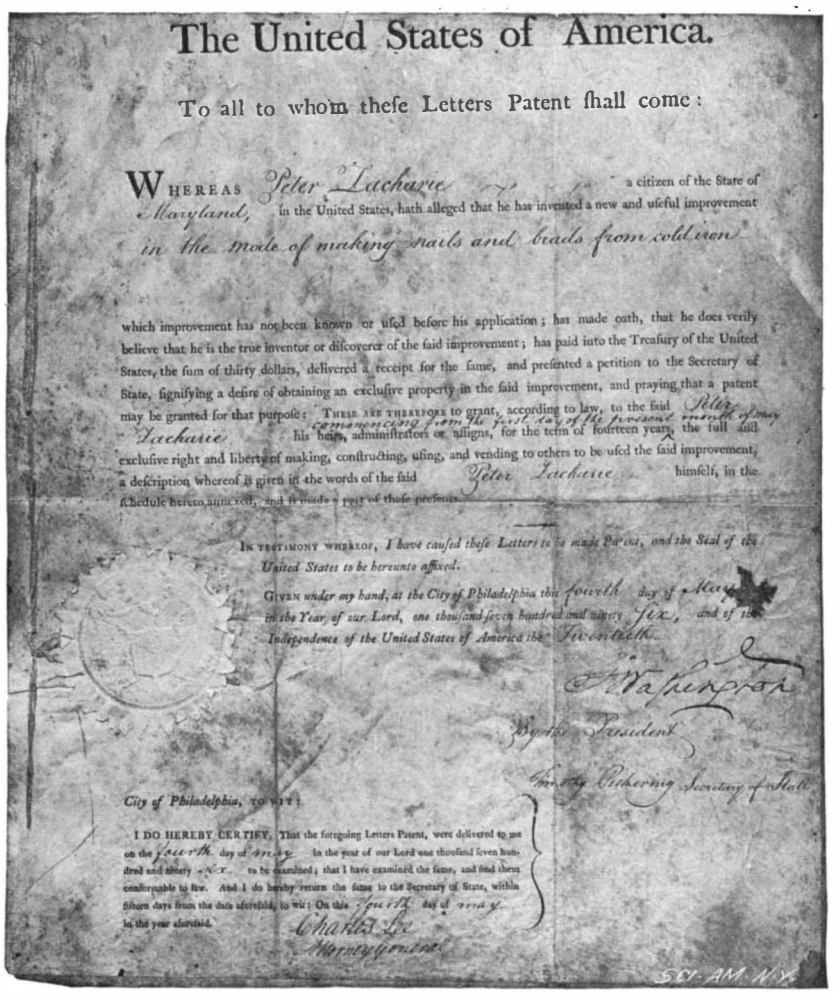
Under the act of 1790 the patent recited that "Whereas the applicant has invented" certain things and the invention appears to be "useful and important," . . . "These are, therefore, . . . to grant" to the said inventor, "his heirs, administrators, and assigns, for the term of fourteen years, the sole and exclusive right and liberty of using and vending to others" the said invention. The patent contained only the title and purpose of the invention. There was no specification or drawing forming a part of the document. The statement that the invention appeared to be "useful and important" was to indicate that the invention had been examined by the Secretary of State and the Secretary of War as required by the act. Following the usual clause of attestation, the patent was signed by the President, George Washington, and by the Secretary of State, who at that time was Thomas Jefferson. The seal used was that of the United States. At the foot of the patent was a certification of the Attorney-General, Edmund Randolph, that he had examined the patent and found it conformable to the patent act. The conjunction "and" which appears before "assigns" was changed to "or" in the patents granted under the later acts.

Under the law of 1793 the patent recited that "Whereas" the petitioner "hath alleged that he has invented a new and useful improvement in" (giving the title of the invention), has "made oath," etc., has paid the fee and has "presented a petition to the Secretary of State" . . . "that a patent might be granted," . . . "These are therefore to grant to the said" inventor, "his heirs, administrators, or assigns, for the term of fourteen years, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used the said improvement, a description whereof is given in the words of the said" inventor "himself in the schedule hereunto annexed, and made a part of these presents." Then followed the clause of attestation and the signatures of the President and Secretary of State. As before, the patent was sealed with the seal of the United States and was certified by the Attorney-General to be conformable to law.

It will be noticed that there was no statement that the invention had been examined as to novelty, as in the patents granted under the prior act, for, under the act of 1793, the patents were granted as a matter of right upon petition to the Secretary of State, the same as is done under the British system. Under the act of 1790 the patent did not refer to an oath, as no oath was required, but the patents granted in pursuance of the act of 1793, it will be observed, recited that the inventor had made oath to his inventorship

The patent had attached to it and forming a part of it a description of the invention, usually in the inventor's handwriting. A drawing was also attached, if two copies of it had been furnished by the applicant, but if only one had been furnished, it was retained in the records of the State Department.

About 1807 the practice was begun of reciting the advantages of the invention at the close of the description, and from 1812 it became customary to close with a paragraph which stated more particularly what the inventor regarded as constituting his invention.



The United States of America.

To all to whom these Letters Patent shall come:

WHEREAS Peter Lacharee of Maryland, a citizen of the State of in the United States, hath alleged that he has invented a new and useful improvement in the mode of making nails and brads from cold iron

which improvement has not been known or used before his application; has made oath, that he does verily believe that he is the true inventor or discoverer of the said improvement; has paid into the Treasury of the United States, the sum of thirty dollars, delivered a receipt for the same, and presented a petition to the Secretary of State, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose: THESE ARE THEREFORE to grant, according to law, to the said Peter Lacharee his heirs, administrators or assigns, for the term of fourteen years, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used the said improvement, a description whereof is given in the words of the said Peter Lacharee himself, in the schedule hereto annexed, and is made a part of these presents.

IN TESTIMONY WHEREOF, I have caused these Letters to be made Patent, and the Seal of the United States to be hereunto affixed.

GIVEN under my hand, at the City of Philadelphia this fourth day of May in the Year of our Lord, one thousand seven hundred and ninety six, and of the Independence of the United States of America the Twentieth.

Go: Washington

By the President

Timothy Pickering Secretary of State

City of Philadelphia, TO WIT:

I DO HEREBY CERTIFY, That the foregoing Letters Patent, were delivered to me on the fourth day of May in the year of our Lord one thousand seven hundred and ninety six to be examined; that I have examined the same, and find them conformable to law. And I do hereby return the same to the Secretary of State, within fifteen days from the date aforesaid, to wit: On this fourth day of May in the year aforesaid.

Charles Lee Attorney General

SCI. AM. N.S.

AN EARLY UNITED STATES PATENT SIGNED BY WASHINGTON

There was no substantial change in the form of the grant of United States patents from 1793 until 1836, except that the language was more conservative, to make it more apparent that the statements of fact were only those of inventor and not of the officials.

The act of 1836 returned to the American system which was inaugurated by the act of 1790, and required that the invention should be examined as to its merits before a patent should issue. It also established the Patent Office as a bureau of the Department of State and created the office of Commissioner of Patents. A seal for the Patent Office was also provided. The patents issued under this act recited the allegations of the petition and oath, the payment of the fee and presentation of the petition. The grant was in the same terms as those used under the act of 1790, and the patent had, as forming a part thereof, a description and drawing of the invention. This act required a particular statement of the extent of the invention, and claims that were more or less crude appeared at the close of the specification. The patent was signed by the Secretary of State, countersigned by the Commissioner of Patents and sealed with the seal of the Patent Office.

When the act of 1849 established the Interior Department and transferred the Patent Office thereto the signature of the Secretary of the Interior was substituted for that of the Secretary of State. Except for the change in the term of the patent from fourteen to seventeen years in 1861, the form from 1836 to 1871 was without change.

The form used at present in granting patents is the one which was adopted in 1871. In this form the previous form is condensed and the statement as to the examination is added.

The grant closes with the clause of attestation and signature of one of the Assistant Secretaries of the Interior, the signature of the Commissioner of Patents, and the seal of the Patent Office. The designation of one of the Assistant Secretaries of the Interior to sign the patents was authorized by an act approved February 18, 1888.

The description and drawing set forth the subject matter of the invention with great clearness, and the claim introduced by the act of 1836 has now become so vital a feature that it is called the life of the patent. While the claim must be supported by the description, the extent of the monopoly depends entirely upon the claim, and the choice of its language is so delicate a matter that the Supreme Court of the United States has said "claim of a patent, particularly if the invention be at all complicated, constitutes one of the most difficult legal instruments to draw with accuracy." EDWIN J. PRINDLE.

United States Patent Office.

WINTON MOTOR CARRIAGES.

Among the notable motor carriages which have been placed upon the market in the last few years are those made by the Winton Motor Carriage Company, of Cleveland, O. The problem which confronted this company when they began their experiments was to produce a motor carriage that would go wherever horses went, and their carriage was given a practical test in running from Cleveland to New York. Our engravings represent the Winton motor surrey and the Winton motor phaeton. The phaeton is a deserved favorite on account of its style, utility, and durability. It weighs 1,400 pounds and the cost of operation is only one-half cent a mile. The driving mechanism is snugly concealed in the body of the vehicle. The motor is of the single hydrocarbon type, simple, powerful, and compact, and is practically free from noise and vibration. The motor is absolutely under the control of the driver at all times and can be run at any desired speed, the motor making from 200 to 1,000 revolutions as is required. The speed of the carriage can be regulated and held at will anywhere from zero to the maximum power of the motor, which is eighteen miles per hour. The carriage is operated by levers, which engage, release, or reverse the driving mechanism and apply the brake. Variable gear for different speeds is not necessary, excepting the hill-climbing and backing gear. The

WINTON PHAETON, SIDE VIEW.

© 1899 SCIENTIFIC AMERICAN, INC.

weight and dimensions are accurately proportioned to the power employed, securing the proper traction. Although intended for two, the phaeton will seat three people. It uses common stove gasoline, which can be obtained in any village, and carries a sufficient quantity for a day's run of seventy-five miles. Each carriage is finished in Brewster green, with leather cushions, dash, and fenders, and handsome nickel trimmings. They are also supplied with top, storm apron, lamp, and gong.

The surrey is another handsome vehicle, and is provided with a motor which is more powerful than the phaeton. The company are also about to build a 1,500 pound delivery wagon with variable speed, the motor having an air governor controlled by a foot-button, which regulates the intake.

Electrical Exhibition Notes.

Each of the Electrical Exhibitions held in this city of late years has been distinguished by some special feature. That of 1896 included the best public demonstration of the Roentgen rays, the transmission of power from Niagara, and the sending of a cable message around the world. The Exhibition of 1898 included a complete church lit by vacuum tubes, the application of electricity to street car traction, the first series of waxworks ever made to illustrate the history of an art, the theatrophone, and the beginnings of wireless telegraphy. The prominent feature of the 1899 Exhibition will certainly be automobilism. The exhibit of electric vehicles will be by long odds the largest and best ever seen in America, and second only to the great exhibits of Paris; in fact, in many respects it will surpass the displays of Europe, because it will illustrate particularly the application of electricity, and because the vehicles shown will demonstrate the high perfection that the art has already reached in this country. This degree of excellence is proved by the fact that, while there is no sale for European automobiles here, the manufacturers in America cannot ship machines fast enough to keep up with the demand. This automobile exhibit bids fair to be a sensation in New York, illustrating as it will the wonderfully wide range of application, carriages and wagons of every type being shown, with many special points of novelty and originality. It has been proposed, in connection with this exhibit, to organize during the show an automobile parade, making a characteristic function of it, after the style of those given in Paris through the Bois de Boulogne. It is believed that something of this character will be arranged while the National Electric Light Association is in session. The fact that to central station sources of supply this great new industry must look for the currents which it is to use gives peculiar interest to the situation, automobile plants being already among the largest consumers that central lighting stations have upon their list of patrons. Several thousand square feet will be occupied by the exhibits of a large number of automobile manufacturers, and in this way a convincing proof will be given to the American public that the new industry is fairly launched on its career. The exhibition will be open from May 8 till June 4.

A great many other important features will be brought forward for the first time, and in an improved shape, at the exhibition; but, in view of the intense public interest manifested in wireless telegraphy, the management have undertaken to organize exhibits in that line of work that will be unusually instructive. It will be remembered that, in 1898, mines and torpedoes were exploded in the central tank by wireless telegraph methods, and other experiments of this nature are being planned for this year; but, in order that the public may see the whole operation itself at a glance, and at the same time go away without any lurking suspicion of the genuineness of the feat, it is proposed to exhibit complete working sets of the apparatus on a long table of glass, the table itself being set up and insulated by blocks of glass, so that there will be a clear view under and around the apparatus. This table will be about 15 feet long, and messages will be sent from one end to the other, the sending signals and the response at the receiving end being heard at once. Visiting telegraphers, operators from newspaper offices, and any other spectators will be allowed to send messages or signals themselves. The same apparatus will also be utilized in connection with the experiments for long distance work, and a series of points have been selected between which and the Garden it is proposed to exchange messages. In this manner the public will have a better opportunity than has ever been afforded before of learning for itself the modus operandi of an invention which is stirring up the world of science no less than the outside public fully as much as the Roentgen rays did at the time of their discovery.

WINTON PHAETON, FRONT VIEW.

Several valuable government exhibits have been secured, and these will be grouped and attractively displayed. They include apparatus from the Army and Navy, the Signal Corps, and the Weather Bureau, and will embrace also not a few interesting electrical relics of the late unpleasantness with Spain.

A special department will also be devoted to electrotherapy—the rapidly widening science of the application of electricity to medicine and surgery, in connection with which a great deal of elaborate apparatus has already been promised. It is the special aim and intention in connection with this exhibit to enable the public to learn for itself how far the science of electricity in the cure and prevention of diseases has gone. The utmost care is being taken to treat the subject on strictly scientific lines, and a committee of eminent specialists has been organized, whose names alone are a sufficient guarantee for the excellence of the work in this department. Another special section will illustrate the great strides made of late years in the application of electricity to dentistry. Here, again, the pervading relationship of the central station to the later branches of electricity will be emphasized, it being a fact that more and more of the practitioners who employ electricity in their work depend upon the power plants for their supply of current, with the intervention of motors and storage batteries.

A number of spectacular exhibits are also being laid out and elaborated by a committee at whose head is Mr. Luther Stieringer, whose work is so well known in connection with the electric exhibits at Chicago, Atlanta, Omaha, etc. This expert has also taken in hand the lighting of the Garden and will produce some entirely new effects, not only beautiful in themselves, but instructive as to the manner in which light should be used for the harmonious illumination of large spaces. A great many of the exhibitors are preparing features of extreme novelty and interest, to which much attention will be called as soon as it is proper to do so.

It is a happy coincidence that this Electrical Exhibition in New York will be in progress at the time the Electrical Exhibition opens at Como, Italy, to celebrate the centennial of the momentous discovery of the electric battery by Volta. The Italian exhibition opens on May 15, and it is proposed, therefore, to hold a special celebration at the Garden on Saturday, May 13, from which fraternal congratulations can be sent by cable. The New York Electrical Society, under whose auspices the exhibition of 1898 was given so brilliantly, has undertaken to reorganize the exercise of this function, and will rally to its aid on the occasion the assistance of other local and national bodies naturally interested in the matter, inviting also, the co-operation of the Italian officials and societies. President Dunn and Secretary Guy are already at work on this matter, which commends itself generally to all who recognize how great is the debt which is owed to the famous Italian from whose work, it may be said, practical modern electricity dates.

Last year the basement was devoted almost wholly to exhibits of engines and boilers, and apparatus of that class. Although this was very successful, a great many of the exhibitors desired to be on the main floor. This has been accomplished in the present exhibition by General Manager Nathan, and the basement will thus be available for a series of very interesting exhibits of a special nature, each of which will constitute a separate entertainment, and all of which will be free to the public. There will be an electrical theater of scenic models, the theatrophone, an electrical Cave of the Winds, an electrical grotto, an exhibit of the uses of electricity under water, and several other features of equal attractiveness. Such of the space as may not have been used in this way will be thrown open to inventors and patentees, who have meritorious inventions which they wish to introduce to the public, and for which they desire to secure capital for exploitation. All likely to be interested in this opportunity are requested to communicate at once with Mr. Nathan at Madison Square Garden, who will arrange to provide them with a reasonable amount of space for their apparatus, and to assist them in every way to make an attractive demonstration at very small cost. It is believed that many worthy ideas and devices linger in obscurity for want of such an opportunity as this, and the experiment will be given a liberal trial, in order to see what it may bring forth of value and importance.

WINTON MOTOR CARRIAGE—SURREY.

© 1899 SCIENTIFIC AMERICAN, INC.

SOME RECENT RESEARCHES ON THE GREAT NEBULA IN ORION.

Under the directorship of Prof. J. E. Keeler, the activities of the Lick Observatory at Mount Hamilton, Cal., with its magnificent 36-inch refractor, have been vastly increased. The wonderful nebula in Orion, one of the most distant and remarkable objects in the terrestrial universe, has been of late the subject of patient and protracted observation by Prof. Keeler, whose conclusions are embodied in the article below, written from information supplied by him and by him carefully revised.

Among the celestial objects which are regarded by astronomers with exceptional interest is the great nebula in the sword handle of Orion. Missed by the acute observer Al Sufi, to whom the nebula of Andromeda was known before A. D. 900, and, singularly enough, by Galileo, it seems to have been first discovered by Cysat, of Lucerne, in 1618. It was independently discovered thirty-eight years later by the eminent Dutch astronomer Huyghens, to whom we owe the earliest of the drawings that have come down to us. Since then it is safe to say that hardly a telescope has been made which has not, at one time or another, been directed to this wonderful object.

Until very recently, the only method of recording the shape of the nebula was that of drawing, by hand and eye, at the telescope. The first drawings were very rough. The positions of the stars in the nebula, as well as the outlines of the nebula itself, were merely sketched in by estimate. It is, moreover, sufficiently obvious that some of the early draughtsmen were by no means proficient in the use of the pencil, though we may concede that their drawings, in the form in which they have been published, owe some of their roughness to the engraver. Later observers conducted their work with more care. They plotted the stars from accurately observed positions, and drew the complex detail of the nebula with reference to the points so obtained. The great reflecting telescopes of Herschel, Lassell, and Lord Rosse were turned upon the nebula of Orion, and in considering the trustworthiness of the drawings made by these eminent observers, and by others with the large refracting telescopes of modern times, the elements of carelessness and lack of skill do not have to be taken into account.

But, in spite of all the care and skill bestowed upon them, these drawings differ greatly from one another. They agree well, it is true, with respect to the Huyghenian region—the bright, sharply defined central area of the nebula—but the faint, diffuse streamers which extend out from it are shown with widely various forms. These differences are due solely to the difficulty of perceiving and depicting such vague, dimly luminous shapes, and arising as they do from the limitations of human perception, they reflect no discredit on the skill of the artist. Of all the drawings that have been published, that which looks most like the actual nebula seen in the telescope is the beautiful picture by Prof. Bond, which forms the frontispiece of vol. v. of the Harvard College Observatory Annals, while the drawing which most accurately represents the forms of the dim, outlying streamers is one made by Lassell, in the pure air of Malta, in the year 1862.

No one would think of making such drawings now. The laborious methods of a few years ago have been superseded by the camera and the photographic plate.

The first photograph of the Orion nebula was taken by Dr. Henry Draper, of New York, on September 30, 1880. Another photograph taken by the same investigator, in 1882, is of great excellence, although it shows only the brighter parts of the nebula. A beginning having thus been made, progress became very rapid. A splendid photograph taken by Dr. Common in 1883, with a three-foot reflecting telescope of his own construction (now in the possession of the Lick Observatory), was awarded the gold medal of the Royal Astronomical Society. Still further advances were made by Pickering, Roberts, and others; and it would seem that the photographic method has now nearly reached its limit, since with still longer exposures the plate is blackened by the general illumination of the sky. By means of these photographs it has been shown that the great nebula is part of a vast nebulous system, which includes a large part of the constellation of Orion.

A photograph taken with moderate exposure is shown herewith, which is not, however, given as a specimen of modern work (since the method of reproduction is entirely unsuitable for such an object as a nebula), but is inserted for convenience of reference and to illustrate some of the remarks which follow. The detail in the central parts of the nebula is almost entirely lost in the process of reproduction.

NEBULA OF ORION PHOTOGRAPHED WITH THE CROSSLEY THREE-FOOT REFLECTOR.

On comparing such a photograph with celebrated drawings, we are struck by some remarkable differences. With respect to the Huyghenian region, photographs and drawings agree very well, but its intensity, as compared with the rest of the nebula, is very much greater in the drawings. This in itself means little, since the amount of contrast on a photograph depends upon the length of exposure, quickness of plate, manner of development, and other circumstances, as well as on the relative intensity of the images which produce the negative. It is easy to obtain a photograph with short exposure which shows the Huyghenian region and nothing else. With long exposures, as all photographers know, contrasts are reduced.

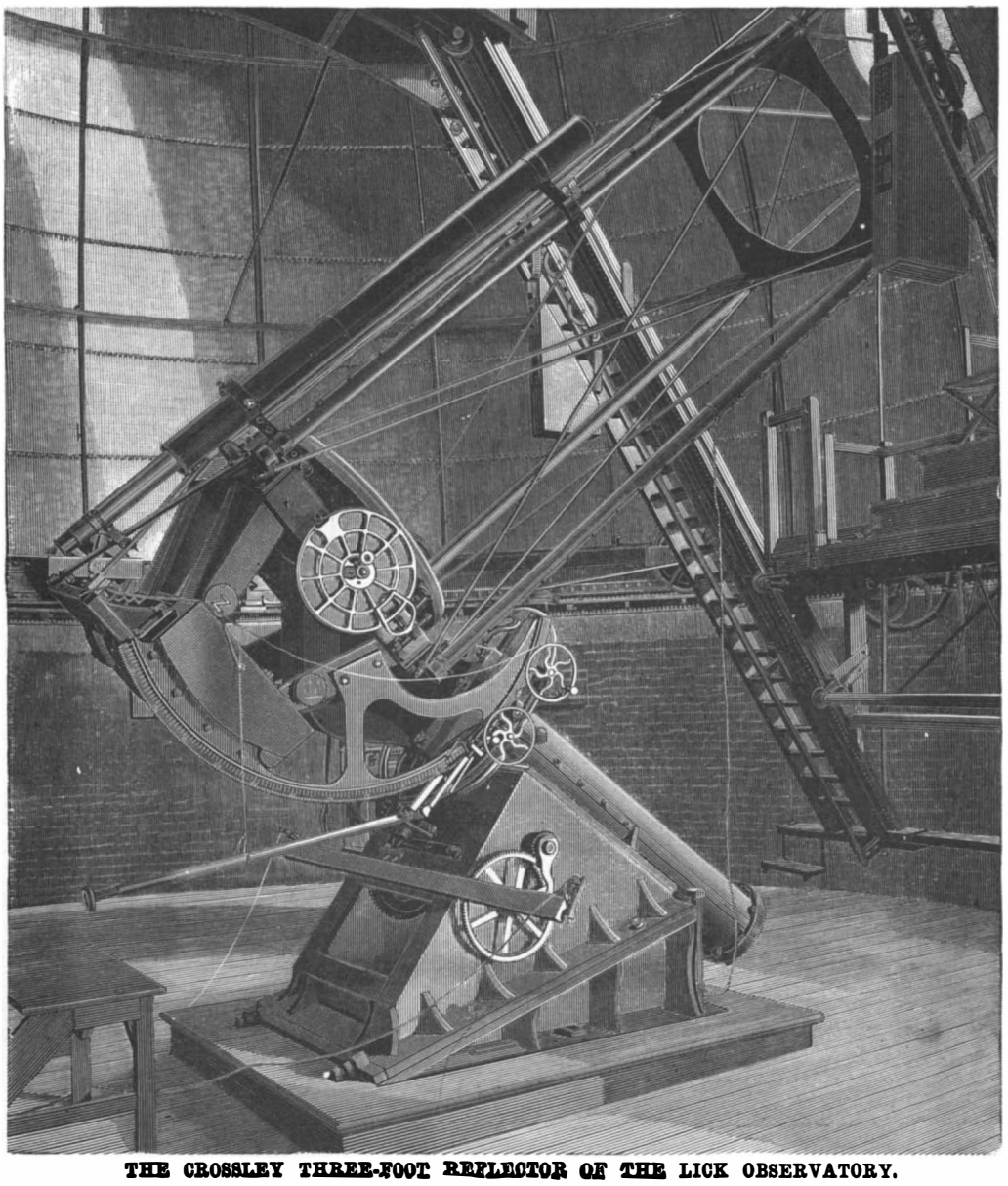
Other differences are, however, less easily explained. Some details (as, for instance, the beautiful curves of nebulosity on the left [west] of the Huyghenian region) are bright and distinct in the photographs, but do not appear at all in the drawings; yet in some cases they appear to be as bright as other features which are easily visible in even a small telescope. Why is this?

To answer this question it is necessary to consider the quality of the light of the nebula as revealed by the spectroscope.

In 1864 Dr. (now Sir William) Huggins, then first applying the spectroscope to the study of such celestial objects, found that the spectrum of the Orion nebula consists of isolated bright lines, among others one or two of the lines of hydrogen. The gaseous nature of the nebula was, therefore, established. Later investigations, chiefly by Sir William and Lady Huggins, Sir Norman Lockyer, and Prof. Campbell, have revealed the existence of a large number of lines, some of which have been identified with lines of hydrogen and helium, while others are of unknown origin. [Prof. Keeler kindly sent a diagram of a spectrum, which it was not possible to publish owing to lack of space. In this diagram the intensities of the lines are represented by varying widths.]

The spectrum of a nebula is regarded with great interest by astrophysicists, because, according to modern views, the stars are evolved from pre-existing nebulæ by a process of condensation. The spectrum of a nebula is, therefore, the starting point of systems of stellar classification, and is of fundamental importance. A few years ago it was independently discovered at the Lick and Allegheny Observatories that all the principal lines in the spectrum of the Orion nebula (with two notable exceptions) are represented by dark absorption lines in the spectra of the stars which are involved in the nebula, and of other stars which belong to the same great nebulous system. In other respects the spectra of the same stars are nearly blank. An intimate relation between the stars and the nebula is, therefore, proved beyond all reasonable doubt.

The two lines which have been noted as exceptions to the statement made above are the two lines which are generally most easily seen in the spectrum of a nebula. One is the so-called "chief" line, $\lambda 5007$ (that is, the line whose wave length is 0·5007 thousandths of a millimeter); the other is the "second" nebular line, $\lambda 4959$. These lines can be readily identified in the diagram of the spectrum by means of a wave-length scale placed above the spectrum.* They seem never to be reversed under any circumstances.



THE CROSSLEY THREE-FOOT REFLECTOR OF THE LICK OBSERVATORY.

A very important discovery was made in 1893 by Prof. W. W. Campbell, of the Lick Observatory, Mount Hamilton, California. Previously to that time it had always been supposed that the visible spectrum of the Huyghenian region was essentially the spectrum of all parts of the nebula. Prof. Campbell, employing a spectroscope attached to the great 36-inch telescope, found that the relative intensities of the three brightest lines changed greatly when he moved his spectroscope slit from one part of the nebula to another. Thus, while in the Huyghenian region the intensities of the lines $\lambda 5007$, $\lambda 4959$ and $H\beta$ were respectively as 4 : 1 : 1, in the neighborhood of the star Bond 734 (shown herewith, surrounded by nebulosity, below the main nebula) they were as 4 : 1 : 20. In general, the hydrogen spectrum was relatively strong in the fainter parts and outlying regions of the nebula.

The significance of these observations has recently been questioned, on the ground that they admit of a physiological explanation. By what is known as the "Purkinje effect," the position of maximum brightness in a spectrum shifts toward the violet end when the

*The last two ciphers are omitted for economy of space.

© 1899 SCIENTIFIC AMERICAN, INC.

light is weakened, even though its quality remains the same. If, therefore, we suppose that two lights, one red and one blue, appear equally bright when the intensity has a certain value, the blue one will appear the brighter when the intensities are equally diminished and the red one will appear brighter when they are increased. On lowering the brightness sufficiently the blue light will even remain visible after the red one has disappeared.

It will be observed that the Purkinje effect acts in the right direction to explain the observations of Campbell, since it was the blue line $H\beta$ which appeared relatively brighter in the faint parts of the nebula, but it seemed very doubtful whether it was competent to explain the amount of the observed differences. The lines observed by Campbell were not at opposite ends of the spectrum, but were close together, all being in the bluish green. The physiological effect must have been small, yet the observed variations of the $H\beta$ line were as much as 20:1. Careful observations made at the Lick Observatory during the past winter have shown that these variations are in fact real, and cannot be explained on physiological grounds.

The non-homogeneity of the Orion nebula must, therefore, be regarded as proved. The substances (or substance) yielding the chief and second nebular lines are more particularly concentrated in the Huyghenian region; in the faint and remote regions hydrogen predominates.

It may be admitted that this non-homogeneity of the nebula may be only apparent, that the substances of which the nebula is composed may be distributed in the same proportions throughout its whole extent, and on account of differences of temperature, density, etc., the spectrum is not everywhere the same; but the fact remains that the quality of the light emitted by the Huyghenian region differs from that emitted by the outlying parts, as if the materials themselves were distributed in the manner already stated.

When this non-homogeneity of the nebula was discovered, it was pointed out by Prof. Keeler, then director of the Allegheny Observatory, that it would necessarily cause a difference between drawings and photographs; for the light from the diffuse hydrogen streamers, though strongly actinic, would scarcely affect the eye. The nebula is seen by one set of rays and photographed by a different set, so that the two impressions cannot be expected to agree unless these sets of rays are emitted in like proportions by all parts of the nebula. This is not the case; and only the amount of the differences thus produced can be called in question.

Prof. Keeler proposed a method for testing this point, and for producing photographs directly comparable with drawings, which he successfully put in practice last winter at the Lick Observatory. The method consisted in photographing the nebula, through a ray filter or color screen, on an orthochromatic plate. The color screen, which had to be chosen with special reference to the nature of the spectrum of the nebula, was of a light green color. It completely suppressed the entire spectrum of the nebula, down almost to the $H\beta$ line, transmitting, therefore, only the lines which are recognized by the eye. By means of orthochromatic plates sensitive to green light the nebular lines $\lambda 5007$, $\lambda 4959$, and $H\beta$ were rendered with nearly their proper visual relative intensities. The image of the nebula photographed through the color screen, in this way, was therefore practically identical with the image which is seen in the telescope in ordinary observation.

The instrument which was used was the three-foot reflecting telescope already referred to as having been made by Dr. Common. This telescope had come into the possession of Mr. Edward Crossley, of Halifax, England, who presented it to the Lick Observatory; and through the offices of Dr. Holden, the former director, it was transferred to California and set up on Mount Hamilton.

The Crossley reflector is a very effective photographic telescope. The Huyghenian region of the Orion nebula can be photographed on an ordinary plate in thirty seconds, and an exposure of five minutes shows a large amount of the surrounding nebulosity. Nevertheless, so feeble is the actinic power of the rays transmitted by the color screen, that the exposures had to be increased from thirty to fifty times to obtain corresponding results when the screen was used. The correct ratio of exposures having been ascertained by experiment, two photographs were taken on the same night, one on an ordinary plate and the other through the color screen on an orthochromatic plate. In order to secure comparable negatives, the two plates were developed together. A considerable number of such photographs was made.

The result of the investigation was that the earlier spectroscopic observations are confirmed and extended, and that the most obvious discrepancies between photographs and drawings are explained. The photographs taken with the color screen are in much better general agreement with drawings than are ordinary photographs. Thus the Huyghenian region is relatively very strong, while the features which have been referred to as abnormally strong on an ordinary photograph, as, for instance, the nebulosity surrounding the star Bond 734 and the nebulous curves west of the Huyghenian region, are much reduced.

Another example of particular interest is the following: The long, scimiter-like streamer, extending upward (south) from the Huyghenian region, is easily visible in small telescopes. It was discovered by Messier in 1771, and is known as the Messerian branch (see Fig. 1). It is, of course, represented in all the drawings. Just to the left of the Messerian branch, and running parallel to it, is a shorter streamer, which is not easily seen, even with large telescopes, and is not shown on any drawing except Lassell's drawing of 1862. Yet on an ordinary photograph these two streamers have nearly equal strength (Fig. 1). The explanation as given by the orthochromatic photographs is, that the lowest nebular lines are strong in the spectrum of the Messerian branch and very weak in that of the companion streamer.

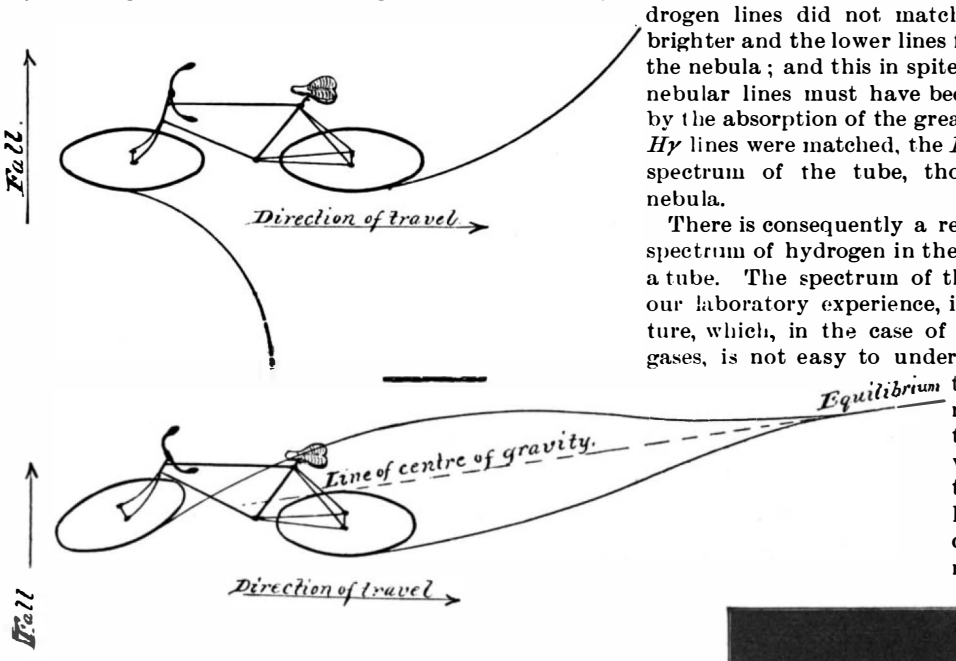
The question has been raised whether the spectrum of hydrogen given by the nebula of Orion is identical with the spectrum obtained from hydrogen in our laboratories, and, incidentally, why it is that the red hydrogen line, $H\alpha$, cannot be seen in the spectrum of the nebula. Prof. Scheiner, of Potsdam, has shown that a hydrogen tube cooled down to —200° C., and excited by feeble electric waves, gives the same spectrum as it does at ordinary temperatures. We cannot suppose, therefore, that the spectrum of the nebula is influenced by the cold of space.

Prof. Scheiner very plausibly explains the invisibility of the $H\alpha$ line as a consequence of the Purkinje effect. A simple observation due to Mr. W. H. Wright, Assistant Astronomer at the Lick Observatory, seems to show, however, that some other than physiological causes are also concerned in this peculiarity of the nebular spectrum.

The great telescope, carrying a spectroscope, was directed to the nebula of Orion, and the light from a hydrogen tube was thrown into the spectroscope, so that the two spectra appeared side by side. The hydrogen tube was mounted on a long slide in such manner that, by simply changing its distance from the slit, the brightness of its spectrum could be altered, while the quality of the light, of course, remained the same. It was thus easy to adjust the tube until any line of the artificial hydrogen spectrum exactly matched the corresponding line in the spectrum of the nebula.

When this was done, it was found that the other hydrogen lines did not match, the upper lines being brighter and the lower lines fainter in the spectrum of the nebula; and this in spite of the fact that the upper nebular lines must have been considerably weakened by the absorption of the great object glass. When the $H\gamma$ lines were matched, the $H\alpha$ line was visible in the spectrum of the tube, though not in that of the nebula.

There is consequently a real difference between the spectrum of hydrogen in the nebula and hydrogen in a tube. The spectrum of the nebula, interpreted by our laboratory experience, indicates a high temperature, which, in the case of such enormously rarefied gases, is not easy to understand. We may suppose that the light of the nebula is excited by electrical disturbances, in which case the temperature of the gases may be low; but of these electrical disturbances we have no independent knowledge. The problem is one of many which still await solution.



Method of Regaining Equilibrium.

Regaining the Balance.

Retaining the True Balance.

The Two White Cords show the Axis of the Head and the Point of Contact of the Wheel.

THE PRINCIPLE OF RIDING THE BICYCLE BACKWARD.

RIDING A BICYCLE BACKWARD.

BY E. J. PRINDLE.

A study of the mechanics of the bicycle is very interesting; for the safety bicycle is a wonderfully perfect machine when considered in relation to the purpose for which it was intended; in fact, it is one of the most perfect solutions of a mechanical problem that has ever been devised. So perfect is the safety bicycle, in fact, that, if the rider has sufficient skill not to interfere with its action, it will travel straight ahead and keep its own balance. The perfection of its design is, perhaps, most easily seen by an analysis of the various ways of riding the bicycle.

To explain the manner of balancing and steering by controlling the front wheel, it is not necessary to go very deeply into the structure of the bicycle. A rider loses his balance when his weight is not over a line connecting the points of contact between the wheels and the ground. To regain his balance, he turns his front or steering wheel in the direction in which he is falling, thus causing the line of contact of the wheels and ground to pass sideways in the direction of the fall until it is again under his center of gravity.

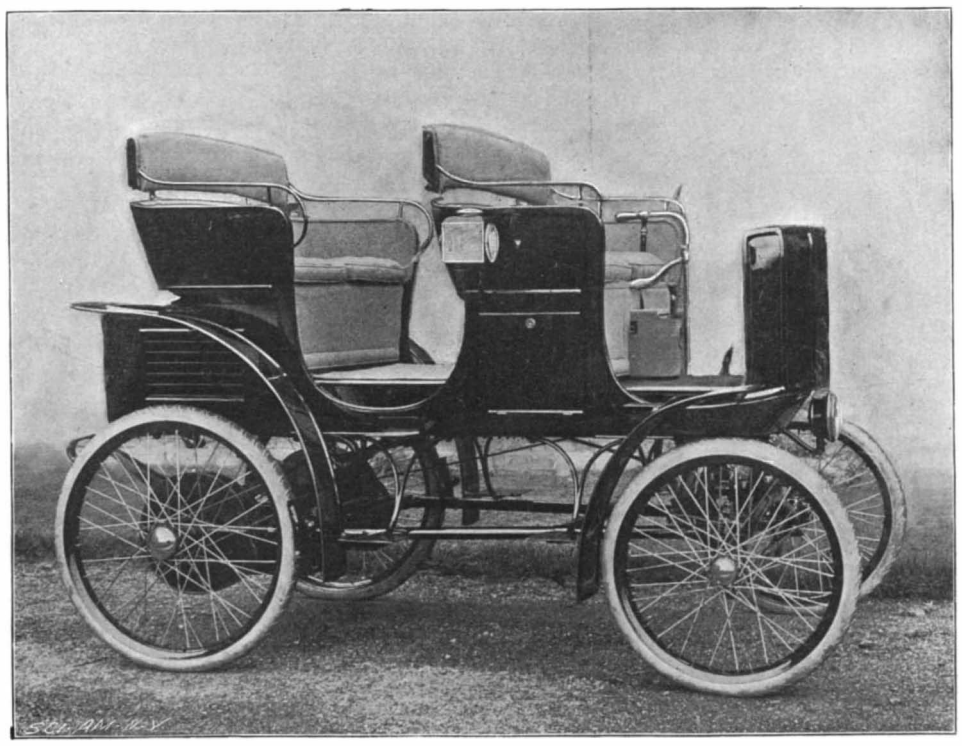
To steer to one side, the rider should throw his

© 1899 SCIENTIFIC AMERICAN, INC.

weight to the side toward which it is desired to go. The front wheel is also turned in this direction, and the tendency to fall is counterbalanced by the constant travel of the points of contact of the wheels with the ground in the direction of inclination. Equilibrium is thus maintained during the turning. When it is again wished to go straight, either the weight is shifted to the opposite side (by leaning) or the front wheel is turned still sharper, as in restoring the balance.

In examining the mechanics of the more difficult features of bicycle riding, it is necessary to consider with more particularity the laws governing the action of the front or steering wheel. The front wheel is mounted on an axle which supports a fork whose stem has a bearing in a rearwardly inclined position in the head of the frame. The fork curves forward as it approaches the axle. If the stem were vertical and the fork straight, the axis of the stem would meet the ground at the point where the wheel rests on the ground. The inclination of the fork stem, however, causes its axis to pass in front of the point of contact of the wheel and ground, thus producing the effect of the caster wheel, such as is used on furniture. The curve in the fork brings the point of contact of the wheel closer to the axis of the stem, and, without destroying the caster action, increases the sensitiveness of the steering wheel. The chief effect of the caster construction is that the point of contact of the wheel, by dragging behind the axis of the stem, exerts a strong tendency to keep the wheel pointed in the direction of motion of the bicycle.

If the stem axis be kept in the vertical plane through the axle, there is no tendency of the wheel to turn to the side when the stem is inclined laterally. When, however, the stem is not kept in this vertical plane and is inclined toward a given side, the wheel turns toward that side until its axle is in the vertical plane passing through the stem. The reason for this lies in the tendency of every body that is free to move to seek the position in which its center of gravity is lowest. In such a position of the wheel, the distance from its center to the ground is less than its radius.



COLUMBIA TWO-SEATED "SURREY" MOTOR CARRIAGE.

Applying this law to the construction of the bicycle, the inclination of the stem axis tends, when the frame is vertical, to turn the steering wheel across the frame. As the frame is tipped further the wheel turns toward the front until, when the frame lies on the ground, the wheel is practically in line with the frame. The wheel turns to the side toward which the frame leans, and this is because the axis of the stem, passing to the rear of the axle, leaves the center of gravity of the wheel in its front.

There are, therefore, two forces acting on the unrestrained steering wheel. First, there is the caster action, which tends to keep the wheel in line with the frame; and, second, there is the tendency of the wheel to turn to the side toward which the frame is inclined and throw the axle into the vertical plane passing through the stem axis. The position which the wheel takes is one due to the resultant of these two forces.

In riding straight ahead with the steering wheel unrestrained, if the balance is lost, the steering wheel, owing to the inclination which the stem axis thus receives, turns in the direction of fall and carries the line of contact of the wheels with the ground laterally until it has passed under the center of gravity of the rider and wheel, when the frame either remains straight or inclines in the opposite direction. In the latter event the steering wheel again automatically restores the balance.

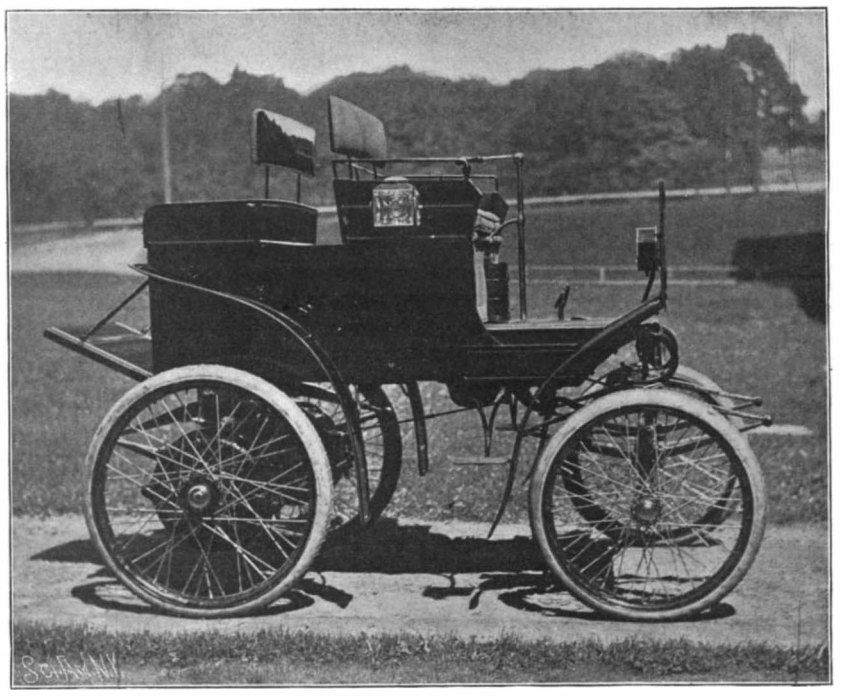
If the rider, when running with hands off, desires to turn to one side, he leans to that side; and the steering wheel turns itself in the same direction. When the turn has been made, the rider leans in the opposite direction until the front wheel has again placed itself in line with the frame.

The acts thus far enumerated are commonly performed; but the feat of riding backward is much more difficult and rare. That this can only be done by manipulation of the steering wheel will be apparent from the following considerations:

In riding backward with the steering wheel free, the point of contact of this wheel drags and seeks to move, relative to the frame, away from the direction of travel. It accordingly approaches the stem axis, turning the wheel across the frame. The steering wheel remains in this position, because it is the position of lowest center of gravity, and because the point of contact cannot go beyond the stem axis. Owing to the position of the center of gravity of the steering wheel in front of the stem axis, the wheel will fall to the side toward which the frame is inclined and will cause the head to run away from the direction of fall, instead of in the same direction as the fall, as it does in riding forward. It is therefore apparent that the bicycle cannot be ridden backward when the steering wheel is allowed to control itself.

Let us see what can be done by manipulation of the steering wheel. If perfect balance could be maintained, the bicycle would travel in a straight line and no trouble would occur. In actual practice, however, the bicycle is always falling either to one side or the other. Suppose it to fall to the right side. The driving wheel, which is now the front wheel, being inclined to the right, will travel in a curve toward the right, as does a coin when it is rolled freely across the floor. The driving wheel is consequently going in the proper direction to carry the line of contact under the center of gravity and restore equilibrium. If, then, we turn the steering wheel so that it travels to the right, the bicycle will travely bodily in the direction of fall, and if this takes place more rapidly than the center of gravity travels laterally, equilibrium will be restored.

The secret of recovering the balance in riding backward lies in turning the steering wheel in the opposite direction relative to the direction of travel of the machine from that in which it is turned when riding forward. Having once learned to turn the handlebar one way in riding forward, it is very difficult to turn it in the opposite direction merely because the bicycle is traveling backward.



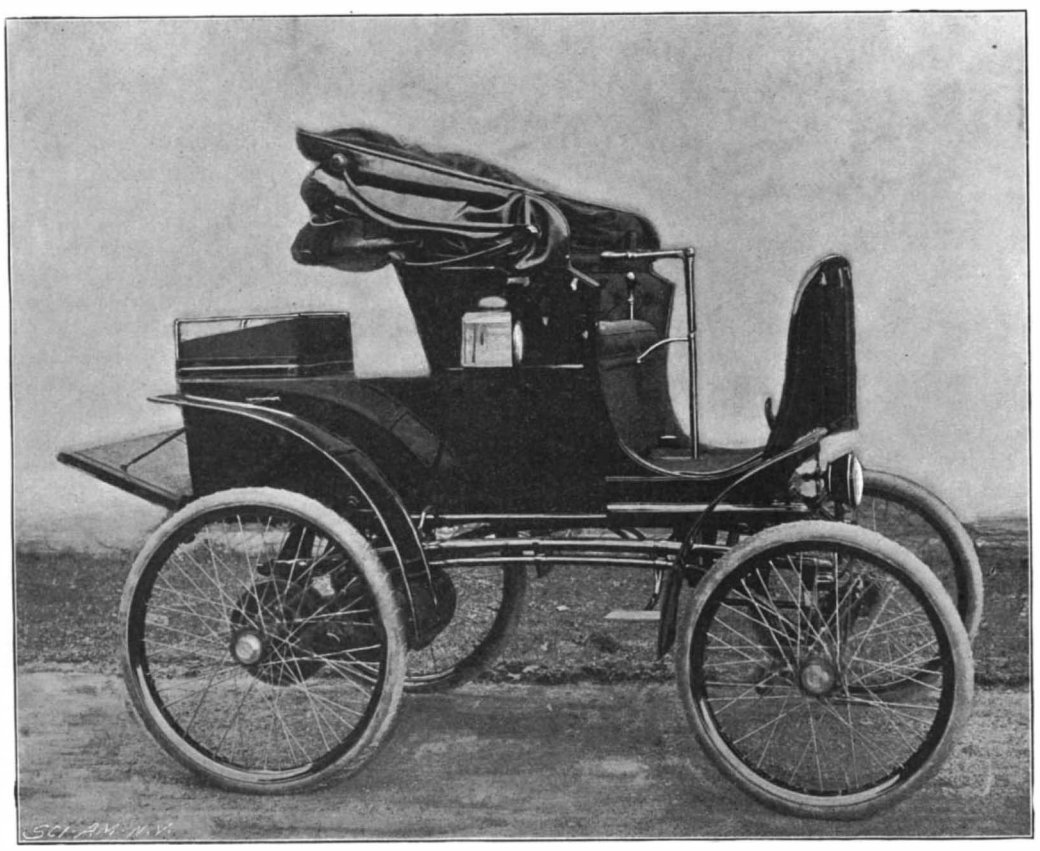
COLUMBIA TWO-SEATED "DOS-A-DOS" MOTOR CARRIAGE.

COLUMBIA MOTOR CARRIAGES.

The three motor carriages herewith illustrated were chosen from the many styles of automobile turned out by the Pope Manufacturing Company as being thoroughly representative of the work done in the motor carriage department of this firm. In every case the motive power is electricity, the company being of the opinion that in the present state of the art electricity, while not without its limitations, fulfills more of the necessary conditions of a successful motive power than the steam or gas engine.

The storage electric motor is clean, silent, free from vibrations, thoroughly reliable, easy of control, and produces no dirt or odor. While it is not so cheap nor of such mileage capacity as some other forms of motor, it is certainly not extravagant in proportion to the service rendered, and its capacity has been proved to be more than equal to the demand of the average city or country vehicle. The greatest demand for an efficient automobile comes, not from people who wish to take long tours through the country, or whose business calls them to any considerable distance from an electric charging station, but from surgeons, expressmen, and those private citizens who wish to keep a carriage, but cannot afford either the space or the cost entailed in providing a team, stable, and coachman.

In order to secure data as to the necessary mileage to be provided for in the storage batteries, the Pope company had cyclometers attached to the conveyances of several individuals who were engaged in occupations in which the automobile would prove serviceable. The investigation showed that the average mileage was 18 miles per day, and except in one case the maximum mileage did not exceed 25 miles. Accordingly, batteries are furnished for the motors that have a capacity of 30 miles per day on level roads and 25 miles on the ordinary grades of a New England city. These figures are, of course, modified by conditions of mud, snow, or rocky roads. The batteries can be charged from any 110-volt direct current circuit such as is used in city lighting. Where current of a higher voltage or the



COLUMBIA DOUBLE-SEATED "PHAETON" MOTOR CARRIAGE.

© 1899 SCIENTIFIC AMERICAN, INC.

alternating current is used the company supply, at moderate cost, a small portable and practically automatic transformer. To charge the batteries from empty to full takes three hours, and the average cost, where current is taken from the city mains, is 60 cents, and the company claims that the average cost of running on a carriage when using current taken from a public station is one cent per mile.

The frame is built of steel tubing manufactured at the Hartford establishment. The wheels are proportioned to meet the specially severe strains of motor carriage service, the front wheels being ordinarily 32 inches in diameter and the rear driving wheels 36 inches. The tire , 3 inches in diameter, are of the Hartford single-tube type, and are provided with a roughened "herring-bone" tread to improve the adhesion. The walls of the tube are of great thickness, and one set of tires has already run 2,500 miles without the need of repairs. The wheels are fitted with ball bearings designed to meet the heavy loads and stresses of the automobile.

The carriages have a maximum average speed of 12 miles per hour on the level, and they can be run at lower speeds of 6 and 3 miles an hour if desired. These speeds are based upon the fact that 8 miles per hour is the legal limit in most cities. The person operating the carriage sits on the left hand side, as this is the convenient side for seeing the wheels of any passing vehicle and judging the distance. The controller, which moves through four positions, from "stop" to "full speed," is at the left hand, and the steering handle is held in the right hand. The brake and reversing lever are operated by the left foot. The brake consists of a bronze band which is tightened over an iron drum on the rear or driving axle. A warning electric bell is carried on each carriage. It is rung by pressing a push button placed in the end of the controller handle already mentioned, and a meter is conveniently placed in sight of the operator, by which he can read at sight how much of the battery power has been used.

EXPLOSION OF A TEN-INCH GUN AT SANDY HOOK.

MR. HUDSON MAXIM REPLIES TO MR. HIRAM S. MAXIM.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of May 6, 1899, appeared a long article signed "Edmund J. Ryves" and another signed "Hiram S. Maxim." All who are familiar with Hiram S. Maxim's style of expression will be able to identify both communications as the work of the same author.

My brother Hiram, in his letter, states that I did not assist him in his early experiments on smokeless powder in England. The same statement is also made in the Ryves article. I have letters in my possession signed by Hiram S. Maxim in which he states that I did assist him very materially in those experiments, which I shall publish in the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT. I am glad that he now claims that I did not assist him in those experiments, because this refutes his previous claims that the inventions which I have patented were on ideas acquired by me from him while assisting him in his experiments.

He also states that an examination of the patents will show who the patentee really was. I will also state that an examination of the patent records will show which of us, Hiram S. Maxim or myself, is the inventor of the most important inventions now used in the commercial manufacture of smokeless powders. The following is a list of my British smokeless powder patents: No. 18,682 of 1894; No. 8,569 of 1895; No. 11,299 of 1895; No. 16,311 of 1895; No. 16,861 of 1895; No. 16,862 of 1895; No. 16,858 of 1896; No. 15,499 of 1897; No. 7,178 of 1897.

The following letter from Dr. Robert C. Schupphaus will explain itself and throw considerable light upon the matter under discussion here.

"Charlottenburg, Germany, September 17, 1898.
"Hudson Maxim, Esq., New York city:

"Dear Sir: Your letter of August 30 was received, telling me of the statements made by Mr. Hiram S. Maxim about smokeless powders, and his claims to being the inventor of important methods and processes, and his further assertion that many of the important features of the Maxim-Schupphaus smokeless powder originated with him and were taken from him.

"I have been long aware that he was making some such claims. In fact, in the fall of 1896 I was told in London, by Mr. Albert Vickers, that he had understood from Mr. Hiram S. Maxim that all the important methods employed by us were taken from him, and that they were his inventions. Mr. Hiram S. Maxim was forced to acknowledge before Mr. Albert Vickers, in my presence, that any such conclusion in regard to the Maxim-Schupphaus powder as Mr. Vickers might have arrived at through remarks of his was false, and that not a single feature of this powder originated with him. I have in my possession a letter addressed to me and signed by Mr. Albert Vickers, for Vickers Sons & Company, Limited, dated London, November 2, 1896, which closes as follows:

"'We undertake not to manufacture this powder without having made an arrangement satisfactory to yourself.'

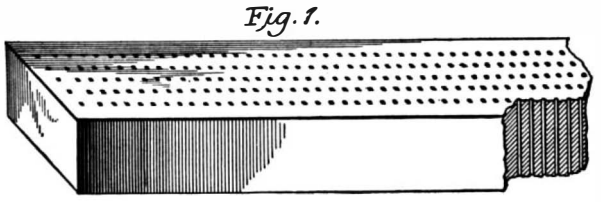
"Anybody who is familiar with the history of smokeless powder and the actual processes of manufacturing these powders knows that none of Mr. Hiram S. Maxim's inventions is being used to-day in the commercial production of any smokeless powder in the world.

"You may give any publicity you wish to this letter in order to meet the unfounded claims made by Mr. Hiram S. Maxim and also to show that, as we stood together and shared the work and the trials in the production of the Maxim-Schupphaus smokeless powder, there is now no disposition on the part of either of us to rob the other of the full measure of credit deserved, and we stand together in sharing the credit as we did in sharing the work. Sincerely yours,

(Signed) "ROBERT C. SCHUPPHAUS."

One such letter, referring to his first smokeless powder experiments, was addressed to Lieut. J. F. Meigs, Engineer of Ordnance, Bethlehem Iron Works, Bethlehem, Penn., dated 32 Victoria Street, London, S. W.,

Fig. 1.



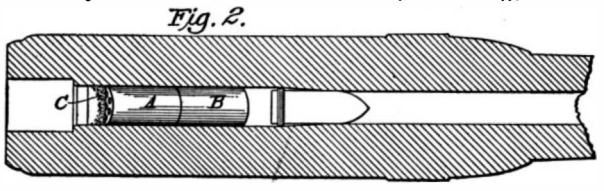
August 8, 1895, in which Hiram S. Maxim makes the following statement:

"My brother Hudson assisted me in my experiments for several months."

In the article signed "Edmund J. Ryves" a statement is made to the effect that the company could not get some of the Maxim-Schupphaus smokeless powder for tests in England, owing to the fact that it was found impossible to make it stand the British stability test. In regard to this, I will refer to Mr. Hiram S. Maxim's remarks on the stability of this powder from his letter to Lieut. Meigs, which will appear in the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT. He says that, according to his own tests, the Maxim-Schupphaus smokeless powder stood twice as long as British cordite.

Last year I sold to Sir William Armstrong, Whit-

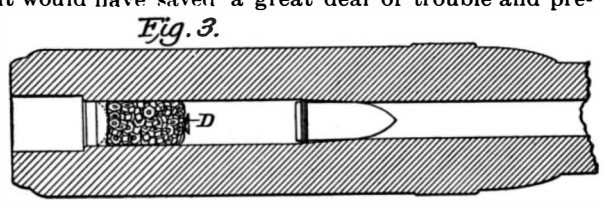
Fig. 2.



worth & Company, eight hundred pounds of Maxim-Schupphaus smokeless powder. They encountered no such difficulty.

It is also stated that: "Mr. Hudson Maxim attributes the disaster to the charge being driven forward into the narrow neck by the pressure, where the grains of powder were jammed together, and an exaggerated illustration is shown with the grains of powder driven forward and jamming in the neck of the chamber. Now, as a matter of fact, in all large guns of modern make, the chamber is very little larger than the bore, the chamber not being bottle-necked to any considerable extent. Mr. Hudson Maxim proposes as a remedy that long bars or sticks of powder should be employed extending the entire length of the chamber, and that these sticks should be transversely perforated. Had the artillerists of the world, who have been experimenting during the last eight years with smokeless powders, exchanged the results of such experiments, it would have saved a great deal of trouble and pre-

Fig. 3.

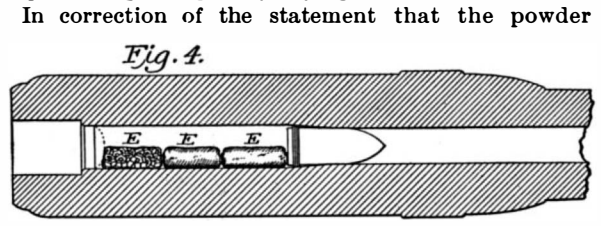


vented a considerable loss of life. This multiple-perforated smokeless powder was tried in my presence over two years ago."

Now, as a matter of fact, the tests which he refers to as having been made in his presence were with ordinary cordite, very irregularly and badly perforated with ragged transverse holes. What I had advised was rods especially made, like that shown actual size in Fig. 1, and 18 inches long and rectangular in form, multi-perforated with small rectangular holes regularly spaced, so as to provide uniform burning thicknesses between the perforations. Furthermore, the cordite which was used was a waste lot which could not be sold for service purposes. It was split up into numerous fissures and cracks throughout as a result of imperfect squirting or by drying.

In correction of the statement that the powder

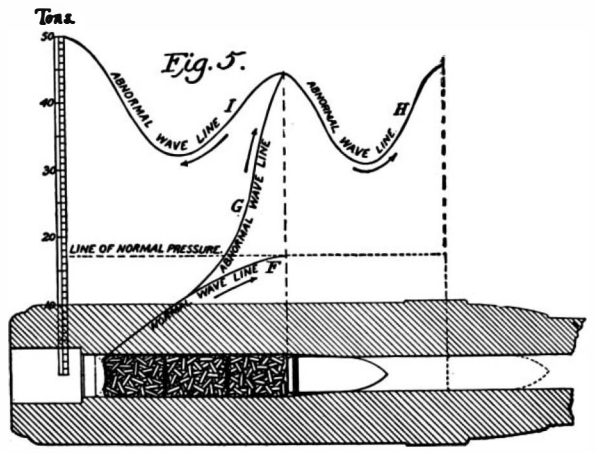
Fig. 4.



chamber in all large guns of modern make is very little larger than the bore, I will call attention to the fact that with the 10-inch gun which burst, the powder chamber was a little more than one-third larger in cross sectional area than the bore, so that a body which would pass freely through the powder chamber would have to be compressed one-third in order to pass through the bore. This is sufficient to account for all I have claimed. I will also quote the following paragraph:

"Now, in regard to the packing or jamming of the powder in the bottle neck of the chamber, this is absolutely impossible. If two sticks of powder are placed in contact and lighted, the evolution of gas from their surfaces is such as to blow them apart. When a large gun is loaded with smokeless powder, the bundle of powder does not by any means fill the chamber. In a 10-inch gun there is at least three inches space above the powder charge. . . . Suppose, for the sake of argument, that the powder should be pressed together in the chamber, it would instantly be thrown back again, because the nearer the powder is together, the higher the pressure and the faster it burns."

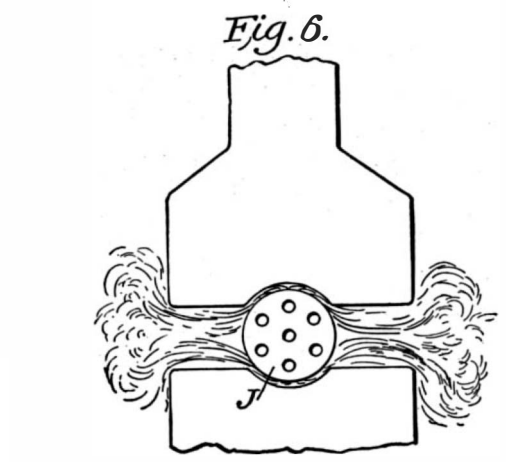
Fig. 5.



Diagrams are shown with an attempt to prove that, owing to the rapid evolvement of gases from the surface of the burning grains, they could not be jammed into the forward end of the powder chamber or crushed; and it is stated that "no amount of pressure will bring two pieces of burning powder into actual contact," and that powder grains in a gun automatically space themselves, contact being rendered impossible, and that 100 tons pressure to the square inch would not force two pieces of burning powder together.

Let us examine this logic. It is not necessary that the grains of powder should come into actual contact in order to produce the jamming, crushing, and bursting effect described by me. The very fact that the pressing together of burning powder grains causes them to be still more strongly forced apart, accords with, instead of being contrary to my claims; for, from that very reason, a higher mounting of pressure and more rapid

Fig. 6.

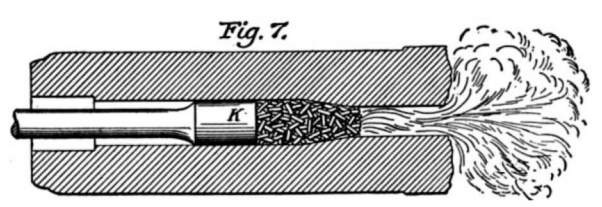


combustion would occur in the narrow neck of the powder chamber, exactly as I pointed out as having occurred in the 10-inch gun which burst. Also witness statement of Mr. Hiram S. Maxim in letter to Lieut. Meigs above referred to:

"With a soft and semiplastic powder in long rods, like the British cordite, it sometimes occurs that the explosion produces a wave action, driving the soft and plastic powder, while still burning, into the forward end of the chamber of the gun. . . ."

There was not, as stated in the Ryves article, at least 3 inches space above the powder charge; 141 pounds of powder was employed, considerably more than the normal charge. The entire powder chamber was filled, as shown in Fig. 5, the grains lying helter-skelter. I understand that, by shaking the powder in the bags very hard, it is possible to get a few more pounds of powder into the chamber. The powder chamber, however, was filled as shown in the figure. The powder was ignited by a flash charge of black rifle powder, *C*,

Fig. 7.



placed at the rear. Now, to arrive at a correct understanding of what probably occurred, let us suppose that two solid cylinders of powder filling the powder chamber were to be employed, as shown in Fig. 2, and a flash charge, *C*, employed to ignite them. They would be thrown violently forward into the narrow neck of the powder chamber, and the forward one would be crushed, and although the pressure at the rear of the first grain would be rapidly mounting, still the pressure in the confined space about the fragments of the forward grain would cause the pressure to

© 1899 SCIENTIFIC AMERICAN, INC.

mount much more rapidly, and the whole charge would again be thrown violently backward, to be again thrown forward by a greatly magnified rear pressure.

In the early experiments with prismatic powder in the United States, and which were very extensive, it was found that a charge but partially filling the powder chamber, as shown at *D*, in Fig. 3, would produce very high and erratic pressures, sometimes mounting to seventy or eighty thousand pounds to the square inch; whereas, if the powder were divided and put into three bags, lying end to end, as shown at *E*, *E*, *E*, in Fig. 4, a low and uniform pressure was always the result. The conclusion was that the charge when employed in the shape shown in Fig. 3 was ignited, it was thrown violently forward, more or less crushed, and again backward, setting up violent wave actions of the products of combustion resulting in very high pressure.

When the charge in the 10-inch gun which burst was ignited, it tended to rush forward like a rocket, to follow the projectile out of the gun, but the impacting of the forward end of the charge into the contracted neck of the powder chamber and against the projectile crushed a portion of the grains, and increased the rapidity of combustion enormously, so that the pressure, instead of mounting on the normal wave line, *F*, shown in Fig. 5, rose to an enormous height, on a line something like *G*. This was followed by a wave of reaction on lines something like *I* and *H*, the projectile having in the meantime moved some distance forward. The wave, *H*, impacting upon it, although it rose very high, did not rise to the height of the wave, *I*, which, impinging upon the stationary breech block, and aided by the accelerated combustion of the powder under its influence at the rear, rose beyond the strength of the gun, blowing out the breech with great violence.

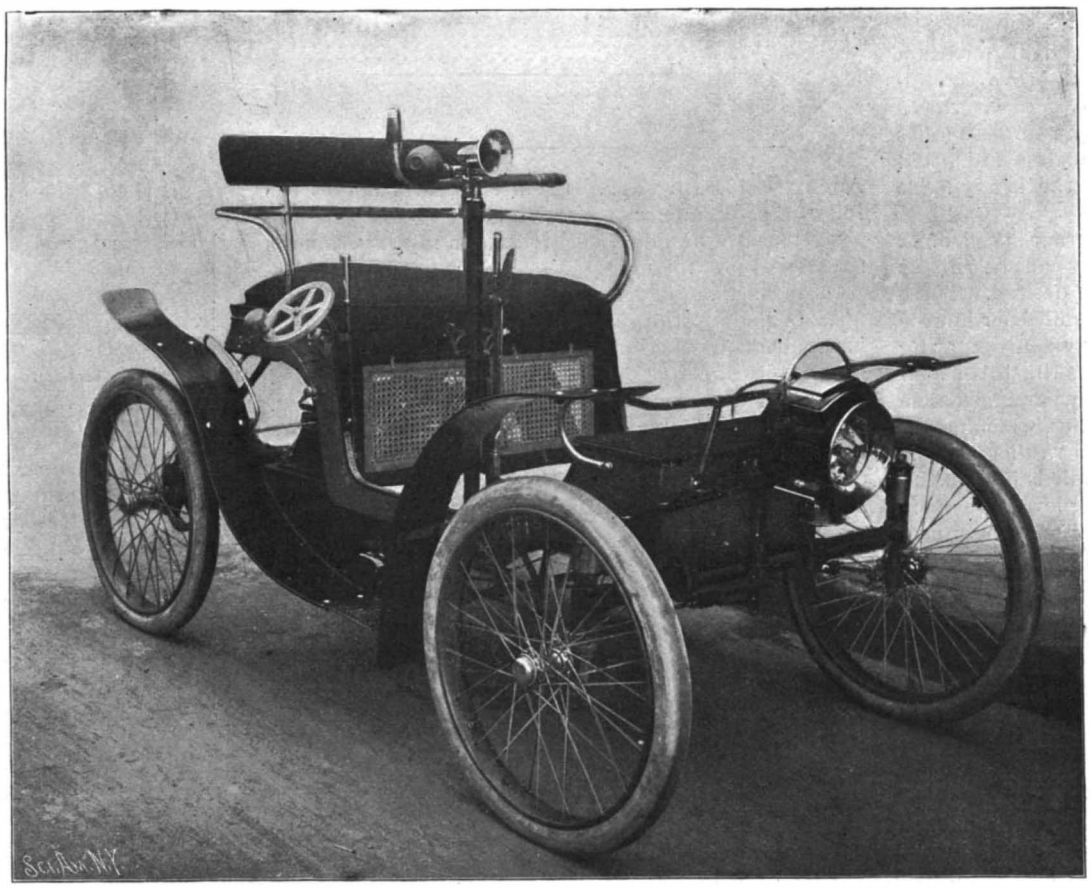
As an illustration of the erroneous claim that the powder grains would not be crushed because not capable of being brought in actual contact, let us refer to Fig. 6. Suppose a powder grain, *J*, were to be ignited on the anvil of a steam hammer. When the hammer descended, it would not come in contact with the burning grain. This would be impossible, yet I think no one will doubt that the grain would be crushed all the same.

To carry this illustration a little farther, let us suppose that a large number of grains be placed in a hollow cylinder with a contracted opening similar to that of the powder chamber and bore of a gun, as shown in Fig. 7. Let us ignite the charge and instantly bring forward with great violence a steam plunger, *K*; would not some of the powder grains be crushed into fragments in being pushed forward into the contracted space?

A similar condition certainly existed in the 10-inch gun that exploded, only the powder charge was thrown forward and compressed in, to the narrow space with enormously greater violence than could possibly be effected with a steam plunger.

In closing, I will add that "collodion" cotton is not employed in the Maxim-Schupphaus smokeless powder, and never has been, as stated in the said article. Neither is the soluble guncotton which we do employ unstable. Soluble guncotton is now made which is as stable as tri-nitro-cellulose and contains nearly as much nitrogen. There is, furthermore, hardly any difference in the explosive value of our gelatin guncotton and tri-nitro-cellulose. The powder charge did not detonate in the 10-inch gun which burst, as only the breech mechanism was blown out. The body of the gun was not disrupted. Had the charge detonated, the entire rear portion of the gun would have been blown to fragments.

The charge which burst the 10-inch gun was ignited at the rear. Had it been ignited simultaneously throughout, there would not have been any excessive pressure. The Maxim-Schupphaus multi-perforated cylinder which has been adopted by the United States government is not in any sense a failure, but the biggest kind of a success. I recommend transversely perforated grains, because I believe them a still greater improvement. Nevertheless, the present multi-perforated cylinder only requires proper loading to give perfect results. The same is equally true with cordite and all other forms of gunpowder. The powder which burst the 10-inch gun had undergone no chemical change whatever.



FRONT VIEW OF THE DECAUVILLE PETROLEUM MOTOR-CARRIAGE.

The United States government would not have benefited by the suggested "interchange of experiments." The experiments conducted with the Maxim-Schupphaus powder in this country have been very exhaustive, and the results attained with it are far superior in every respect to anything that has been produced elsewhere in the world, and there have been fewer accidents.

Results of experiments with multi-perforated cylinders have shown greater uniformity in velocities and pressures under all circumstances than have been attained by any other form of powder in the world. In many instances, the velocities and pressures during a large number of shots have been practically as uniform as the instruments could measure. The United States government will not abandon multi-perforated powder grains, but instead, other governments must soon follow the lead of the United States in the use of the multi-perforated smokeless powder.

In confirmation of the above statements about the ballistic value of the Maxim-Schupphaus powder, I refer to the report of the Chief of Ordnance of the United States Army, of 1896, page 197. After dwelling upon the numerous advantages of this form of powder, the conclusion is reached that:

"All things considered, the perforated cylinder or disk proposed by General Rodman many years ago, and recently revived in the Maxim-Schupphaus powder, appears to me to be the most suitable and promising form for the colloidal smokeless powders."

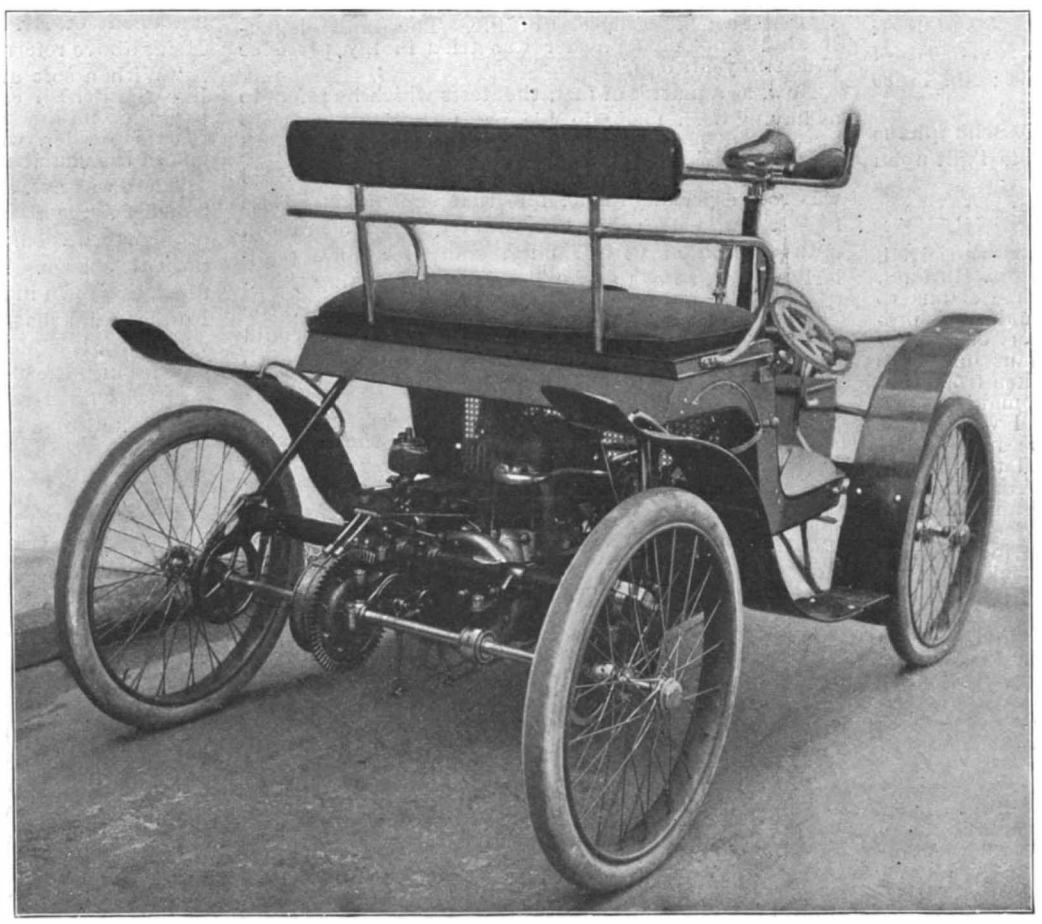
HUDSON MAXIM.
219 West Thirty-fourth Street, New York.

THE DECAUVILLE MOTOR-CARRIAGE.

In the 1898 automobile race from Paris to Amsterdam, a distance of 1664 kilometers (1023 miles), the first prize in its class was won by the Decauville "voiturelle," in fifty-four hours.

The Decauville carriage is driven by a two-cylinder, four-cycle gas engine of the Otto type. The motive agent employed is naphtha, contained in two vaporizing-chambers or carbureters of a capacity to enable the carriage to run fifty miles without replenishing its supply. The air admitted to these chambers forms, with the naphtha vapor, an explosive mixture which is conducted to the cylinders. As in the De Dion-Bouton motor tricycle, the naphtha is prevented from cooling by evaporation, by conveying a part of the hot, exhausted gases through a small tube passing through the carbureters. The two cylinders of the motor have external flanges or ribs so as to obtain a large radiating surface and to prevent overheating. The mixture of air and gas is exploded by means of an electric spark. The pistons are single-acting trunk-pistons, which drive the rear axle of the carriage by means of gearing.

The engine, as before mentioned, is of the four-cycle type. When a piston descends, the intake is opened and the explosive mixture of air and vapor is admitted into the cylinder. When the piston rises, the intake closes and the gas is compressed. Just as the piston is about to descend for the second time, an electric spark explodes the gaseous mixture and drives the piston suddenly down. On the following up-stroke the exploded gases are exhausted. When the first cylinder is in its third period (that of explosion), the second cylinder begins its first period (that of admission), so that the two pistons act alternately on the motor shaft.



REAR VIEW OF THE DECAUVILLE PETROLEUM MOTOR-CARRIAGE.

The accompanying illustrations represent two views of the automobile. Beneath the front edge of the carriage-seat three small levers are mounted, which, by means of connecting mechanism, respectively control the admission of gas to the cylinders, regulate the time of ignition, and control the compression. Like all gas engines, this motor must be started by hand; for which purpose a crank wheel is mounted on one side of the carriage. A lever mounted below the crank wheel on the side of the carriage controls the admission of air to the vaporizing chambers, and, therefore, regulates the carburization. By means of a pedal in the floor of the carriage and a long lever mounted in front of the driver's seat, the motor can be thrown in and out of gear with the rear axle.

The carriage is provided with two changes of speed and is steered by means of a handle bar in front of the seat. The automobile weighs about 500 pounds and has a maximum speed of 20 miles per hour. This handsome vehicle has recently been imported to this country by Mr. P. Cooper Hewitt, of New York, and it is now being tested.

IN three years the cost of running an Atlantic steamer exceeds the cost of construction.

© 1899 SCIENTIFIC AMERICAN, INC.

THE DE DION-BOUTON TRICYCLE.

Nowhere has the development of automatically propelled vehicles reached a more advanced stage than in France, where, on account of the fine roads and pavements, the most favorable conditions are found for their operation. Carriages and tricycles operated by gasoline motors are now among the ordinary sights in the streets of Paris. Among the latter the tricycle De Dion-Bouton is most extensively in operation, and may be considered as typical of this class of vehicles.

The motive power used is that of a small hydrocarbon motor, operating on the same principle as the gas-engine, the gas being furnished by the evaporation of gasoline contained in a vaporizing chamber, and then mixed with air to form an explosive mixture, which is then conducted to the chamber of the motor, and which by its explosion at proper intervals operates the piston.

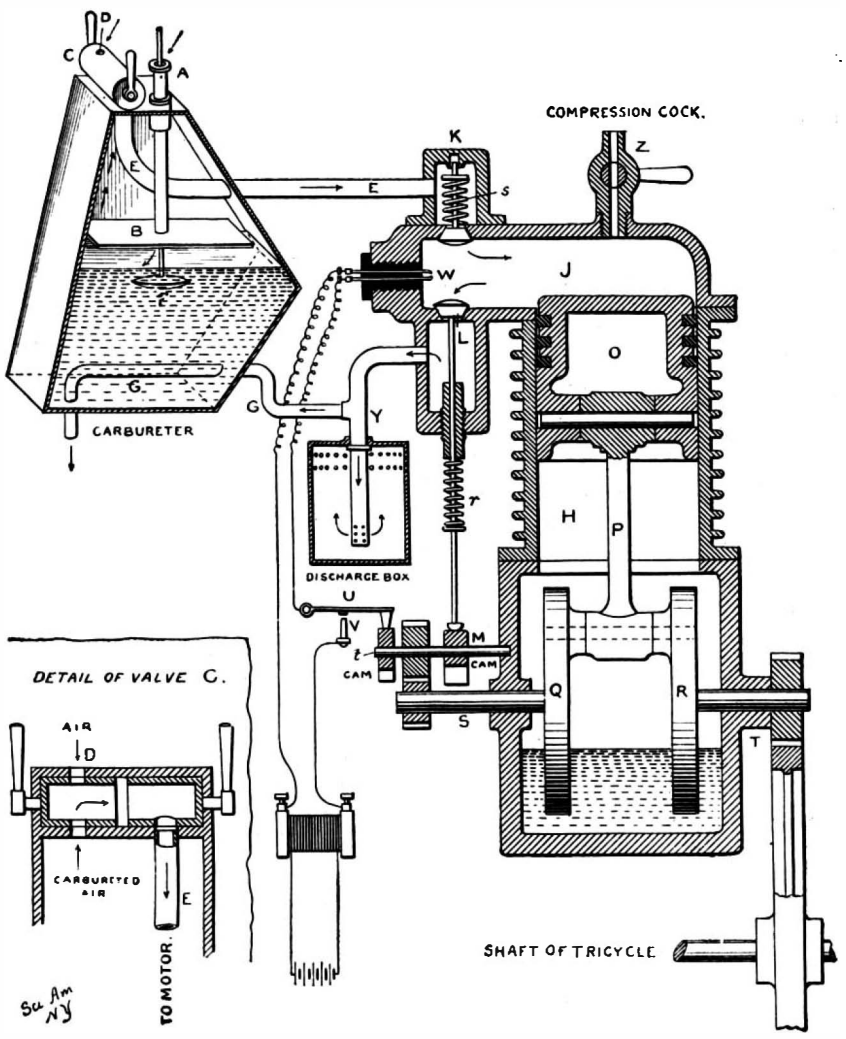


Fig. 1.—SECTION OF TRICYCLE MOTOR.

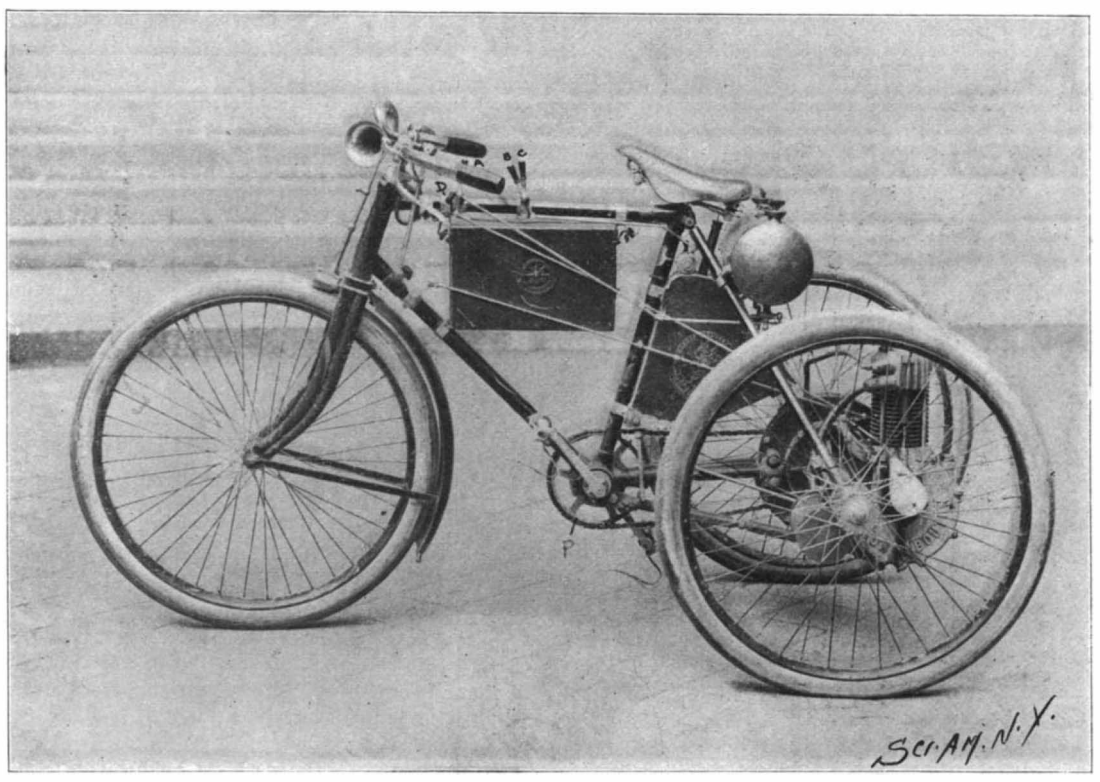
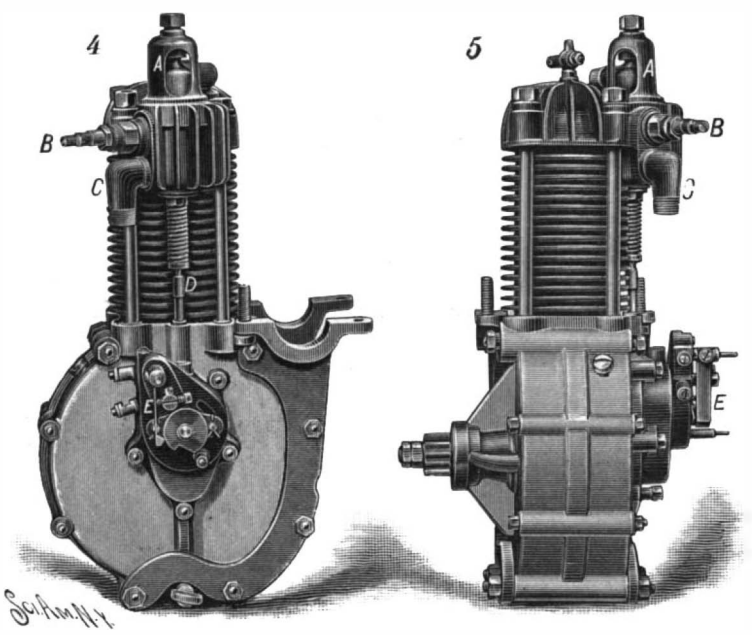


Fig. 2.—THE DE DION-BOUTON AUTOMOBILE TRICYCLE.

The action of the motor will be seen by referring to the diagram shown in Fig. 1. To the left is the vaporizing chamber or carbureter, in which the gasoline contained in the lower half is brought into contact with the air entering by the tube, *A*, and made to pass between the horizontal plate, *B*, and the surface of the liquid; the carbureted air then rises, as shown by the arrows, and enters the double valve, *C*, shown below in detail, by which it is mixed with an additional quantity of air, which enters by the orifice, *D*, at the top; the mixture then passes to the motor by means of the tube, *E*. The admixture of air is regulated by the handle on the left, and the supply of gas by that on the right. The float, *F*, serves to indicate the level of the gasoline in the carbureter by means of a rod which passes through the tube of admission; and the tube itself is arranged to slide up and down in order to maintain a constant difference between the horizontal plate and the surface of the liquid, this plate being attached to the lower end of the tube. In order to avoid the cooling of the gasoline by evaporation, it is warmed by means of the tube, *G*, through which passes a portion of the hot gas escaping from the motor. By this means a nearly constant temperature is obtained for a given speed of the motor.

The cylinder, *H*, of the motor is of cast steel, with projecting flanges which serve to increase its radiating surface and prevent overheating; above is the chamber, *J*, in which the explosion of the gas takes place; at the top of the chamber is the valve, *K*, which admits the gas coming from the carbureter; the valve is normally closed by means of the spring, *S*, whose pressure is regulated so as to allow the valve to open upon the descent of the piston. Opposite is the exhaust valve, *L*, which permits the waste gases to escape after the explosion; to the valve, *L*, is attached a rod which passes through the cover of the exhaust chamber and engages with a cam, *M*, which, by pushing up the rod, opens the valve at the proper instant, this valve being normally closed by the spring, *r*. At *W* is shown the igniter, consisting of two copper rods passing through an insulating bushing and so arranged as to allow a spark from the induction coil to pass in the interior of the chamber for the ignition of the gas. The piston, *O*, is a hollow steel casting provided with three packing-rings, and carrying the wrist-pin. The piston is connected with the inclosed fly-wheels, *Q* and *R*, and with the shafts, *S* and *T*, by means of the piston-rod, *P*. The shaft, *S*, carries a pinion which engages with another of twice its diameter, operating the small shaft above, *t*, which carries two cams; the cam to the right serves to open the exhaust valve once in every two revolutions, while that to the left acts upon the lever arm, *U*, carrying the contact, *V*, of the induction coil, by means of which a spark is caused to pass at *W*, thus igniting the gas contained in the chamber of the motor.*

This induction coil is operated by four dry piles. From the preceding description the action of the motor will be readily understood. When the piston descends, it produces a vacuum in the top chamber, by the action of which the valve, *K*, opens, admitting the detonating mixture from the carbureter; when the piston rises, it compresses this gas and the valve of admission closes. At the instant of the second descent of the piston the cam actuates the lever, making contact with the induction coil, upon which a spark passes, causing an explosion of the gas, which pushes the piston with sufficient force to cause it to pass twice through the same position; when the piston rises after its descent, it compresses the residual gases of explosion, and at this instant the cam, *M*, lifts the exhaust valve and the gas



Figs. 4 and 5.—MOTOR FOR DE DION-BOUTON TRICYCLE.

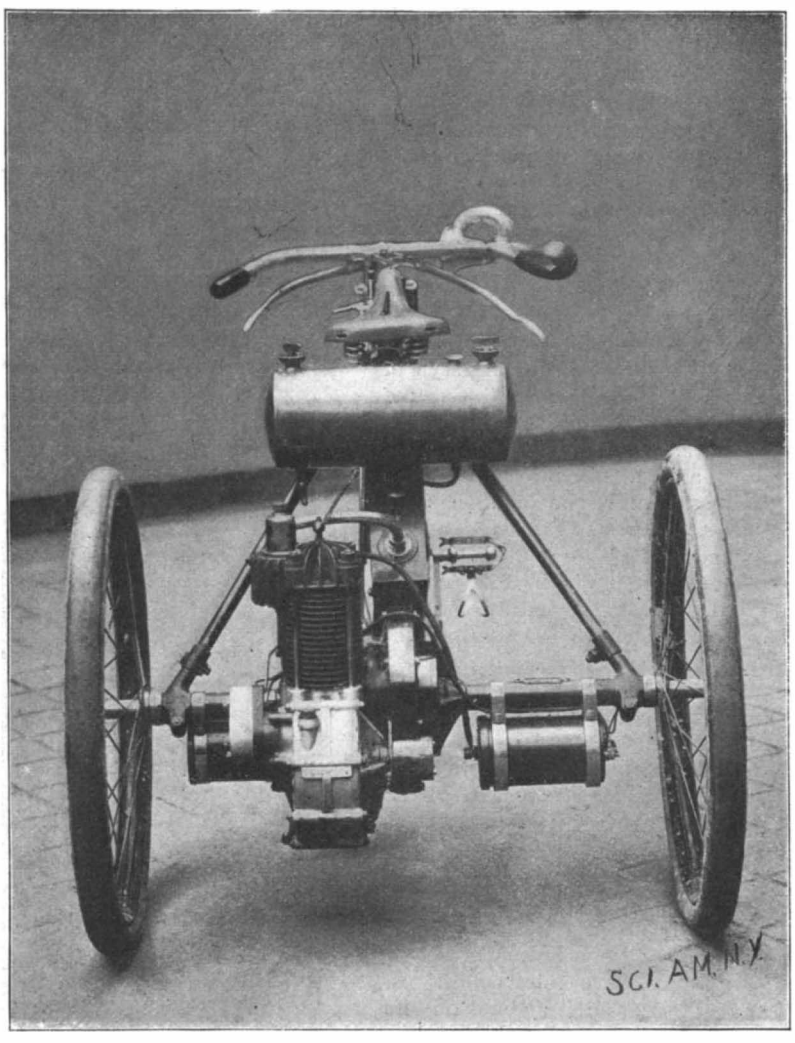


Fig. 3.—REAR VIEW OF TRICYCLE SHOWING MOTOR.

* Shaft, *T*, carries a pinion which engages with a gear wheel on the shaft of the tricycle.

© 1899 SCIENTIFIC AMERICAN, INC.

leaves the motor by the exhaust pipe, *Y*. When the piston redescends, this valve closes and the upper valve opens, as before, to admit a fresh supply of gas and so on.

The action of the motor is thus determined by four different periods, which may be characterized as (1) introduction of gas, (2) compression, (3) explosion, (4) evacuation of the products of combustion.

Figs. 2 and 3 show the tricycle complete. In Fig. 2 the handle, *D*, serves to open or close at the proper time the cock shown in the diagram, Fig. 1, at *Z*, which permits the piston to ascend and descend freely when starting the motor. The handle, *A*, displaces the support of the contact of the induction coil in order to vary the instant of ignition with relation to the introduction of gas; the handles, *B* and *C*, serve respectively to regulate the admission of gas to the motor and the introduction of air into the carbureter. The pedal, *P*, operates the main axle of the tricycle and at the same time starts the motor, which is geared to the same axle. The tricycle may be operated by the pedal alone in case of accident or in mounting steep grades.

Figs. 4 and 5 show the motor dismounted and provided with a frame for securing it to the tricycle. *A* is the admission valve; *B*, igniter; *C*, exhaust pipe; *D*, rod and spring of exhaust valve; *E*, contact, cam, and binding-posts.

The maximum speed of the tricycle is 40 kilometers (24 miles) per hour, and grades of eight to ten per cent may be mounted without the aid of the pedals.

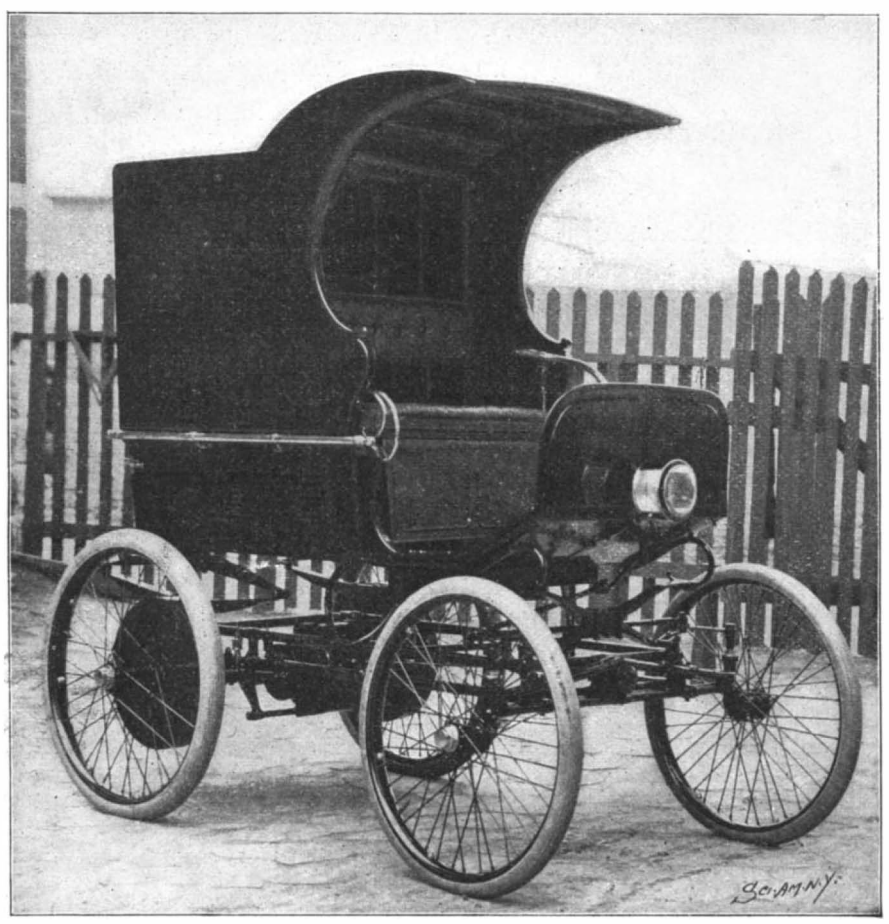
The Waltham Manufacturing Co., of Waltham, Mass., will exclusively sell the product of De Dion-Bouton & Co. in the United States, and in addition to selling the regular machines now manufactured by De Dion-Bouton & Co. they will import the De Dion motors and make a complete line of "Orient motor cycles and motor carriages." They are now building tricycles, trailers and attachments, tandems, and a light carriage, and will add other vehicles.

Paris. E. BERNARD.

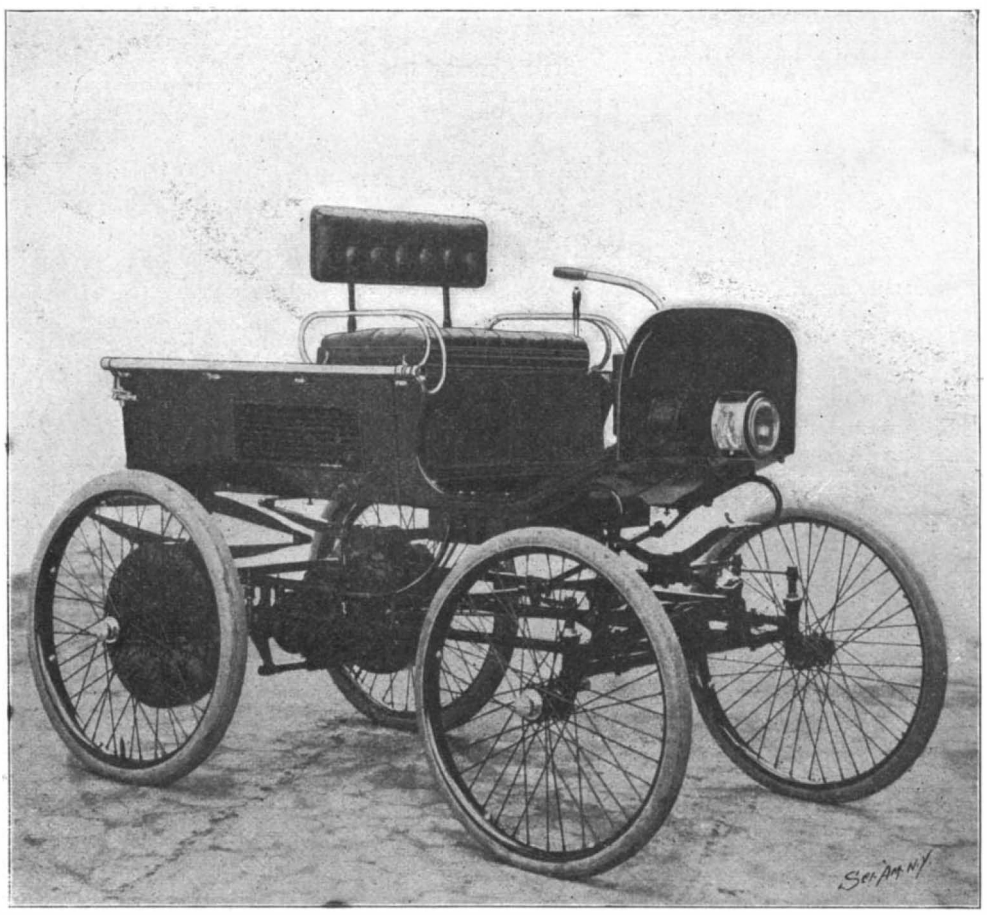
A COMBINATION PLEASURE AUTOMOBILE DELIVERY VEHICLE.

Our engravings represent a unique form of vehicle which is made by the Indiana Bicycle Company, of Indianapolis, Ind., manufacturers of the "Waverley" bicycles. The peculiarity of this carriage is that the delivery body is separate from the body proper, so that it can be used for the delivery of parcels or as a pleasure vehicle. This style of vehicle is intended for the use of merchants when they desire to have a delivery wagon for use on week days and a pleasure vehicle on Sundays, and the change from business wagon to carriage is quickly made.

The carriage weighs 3,310 pounds and is operated by electricity, furnished by forty-two 80-accumulator cells. There is a specially designed multipolar motor of two and a half horse power which drives the vehicle. The shaft is geared directly to the rear wheel, propelling the vehicle by a single reduction. Each rear wheel revolves independently of the other through compensating gears which are placed in line with the motor shaft. It has five speeds, varying from three to twelve miles per hour, and the radius of action is, under favorable conditions, about forty miles; but on its trial trip, with the batteries as taken from the forming room, and not having a regular charge, the wagon made 54·6 miles, coming in strong at the end of the trip. The load was only two men. During this run it went through unimproved streets, over grades, some of which amounted to 7 per cent, and was put through as severe a trial as possible in a city like Indianapolis. The greater part of the run was made, however, on well paved streets, as it is likely that a vehicle of this kind would generally be used where the streets and roads are fairly good. The running gear is of tubular construction, and the wire wheels have ball bearings throughout and are fitted with Royal single tube pneumatic tires. The delivery body is separate from the body proper and is furnished with angle irons along the lower edges which engage slotted tubes attached to the body by brackets, and sufficiently raised to prevent contact, thereby protecting the finish. The slotted tubes are raised by their brackets sufficiently to carry the delivery box about ⅝ of an inch above the body proper. The wagon which we illustrate is now running about forty miles a day in Indianapolis and is considered to be a very successful vehicle. The same company are making a number of other styles of automobile carriages and vehicles, but the one we illustrate is of particular interest owing to its convertibility.



INDIANA BICYCLE COMPANY'S CONVERTIBLE MOTOR DELIVERY WAGON



THE SAME VEHICLE, WITH THE TOP REMOVED, CONVERTED INTO A PLEASURE CARRIAGE.

Value of Trade Marks in the Philippines.

According to a Consular Report which has just been issued, trade marks are worth a great deal in the Philippines. One representative firm of importers writes as follows:

"Well-known marks are worth a great deal in this country. Take, for instance, our mark 'cock in cage,' for white drill. The same quality, the same size, or even wider, imported by other houses is paid for at the rate of $8.50 a piece, which leaves a modest margin. We sell our brand at $10, and dispose of 50 to 60 cases a month in Manila and 20 cases in Iloilo."

In view of facts like these, American firms who are thinking of trading in the Philippines should obtain protection of a duly registered trade mark.

Wrappings for Bicycles.

Notwithstanding the rapid improvements which have been made in the construction of bicycles, the method of packing and covering them for wholesale delivery is still in a primitive condition. It is one of those details, apparently trivial, which get overlooked, says The Cycle Age and Trade Review, and the ancient method of swathing frames and wheels in yards and yards of intricate paper or fabric bandages is yet with us. The system teems with disadvantages and difficulties, the number of packers required, the space necessary for wrapping at the factory and unwrapping at the sellers' stores, and the untidiness of this operation, are all sufficient reasons against perpetuating the present methods.

A Birmingham inventor has recently devised a system of protecting the frame by means of tubes of stiff paper or cardboard slotted longitudinally, so that they may be slipped over the frame tubes and held in position both by their natural contraction and by tapes or other suitable additions. For all ordinary purposes the tubes, such as used for containing photographs, form ample protection for the frame; but the inventor also provides for the lining of these tubes with a soft material for additional protection and for attaching fabrics at the ends of the tubes to wrap over the lugs.

Specialism in Bicycle Construction.

The tendency toward specialism, which is a marked feature and one of the most important secrets of our success in the mechanical industries, is seen in a very high state of development in the manufacture of bicycles. In the earlier history of the wheel, when makers were few, and shapes and dimensions were necessarily experimental, it was customary for each firm to build its machines practically from the ground up. The manifest advantages in respect of economy resulting from specializing the work are responsible for the growth of several large establishments which are devoted entirely to the construction of some single part of the wheel. These firms are in the habit of buying up all the patents possible covering their particular form of construction, and an inquiry as to the number of patents thus controlled suggests what a large amount of inventive thought has been bestowed on the bicycle as a whole to bring it to its present perfection. A good case in point is the Fauber crank hanger, the manufacturers of which now control as many as seventy patents on this part of the wheel alone. Of course it will be understood that these patents cover the cranks, sprockets, and hanger combined; but even in this case the total number of patents is extraordinary, and suggestive of the searching scrutiny to which every item of the bicycle is being subjected in the endeavor to bring it to the highest mechanical efficiency.

Work at the Rock Island Arsenal.

The War Department is to develop at once the machinery plant at the Rock Island Arsenal to such an extent that it will turn out 2,500 Krag-Jorgensen rifles per day. There is no intention of curtailing the work on small arms now in progress in the Springfield Arsenal. The latter plant will still continue to supply the bulk of arms called for in times of peace, and the Rock Island Arsenal will be developed so as to have a vast reserve power in time of need. The ordnance officers state that the war last summer shows that private establishments cannot be depended upon to install equipment rapidly enough to meet emergencies. Congress has appropriated $500,000 for ordnance work. All of this sum is available for the Rock Island Arsenal. There are at present 1,500 men employed in the works, and last July they numbered 3,000.

The St. Louis Fair.

The subscriptions from various sources for the St. Louis fair have now amounted to $2,673,000, in addition to the $2,100,000 pledged by collecting committees. The amount so far actually raised is now close to the $5,000,000 originally promised.

© 1899 SCIENTIFIC AMERICAN, INC.

LABORATORY TESTS OF THE BICYCLE.

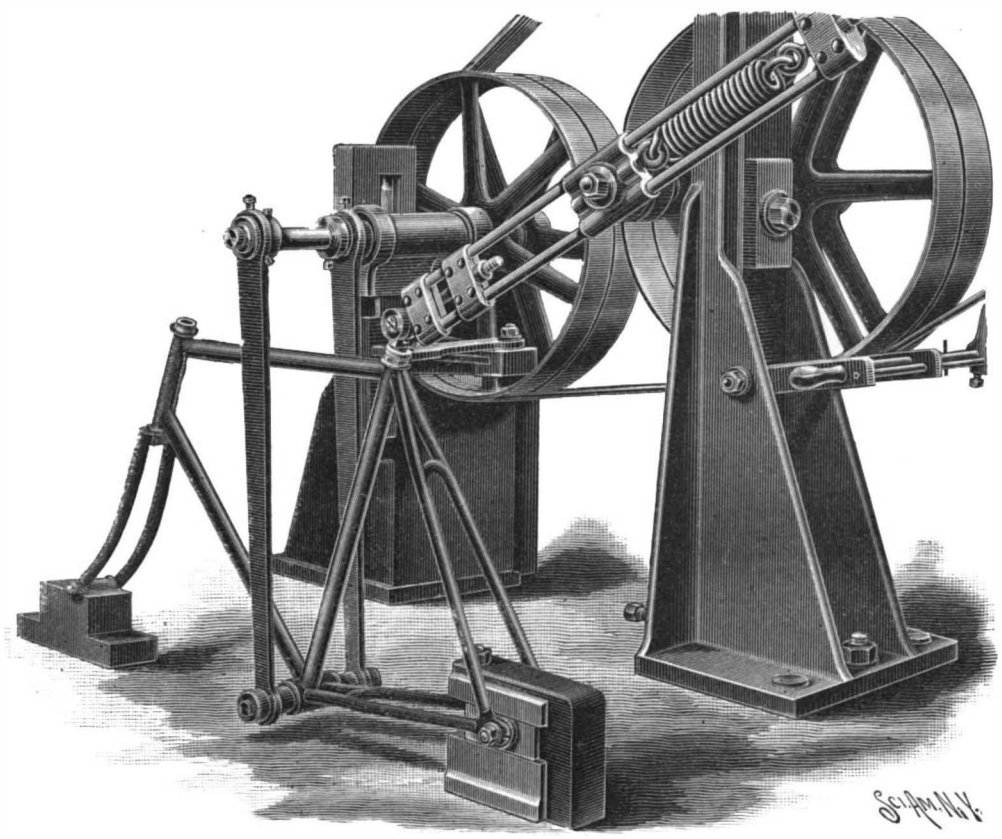
There is probably not a machine in the world that works on such a small margin of safety as the bicycle. It has been estimated that the safety "factor" is only about 1¼ in the lightest machines, and while this is probably too low an estimate, it is certain that, when a powerful 200-pound rider is climbing a steep hill, or worse, coasting down a hill whose surface is rough and lumpy, the margin of safety must be a very narrow one—narrow, that is to say, compared with that allowed in other forms of mechanical construction. Thus the bridge builder provides sufficient steel in the various members to insure that the heaviest possible loads that can come upon them will not strain the metal above from 20 to 30 per cent of its elastic strength, and even in designing structures that are subject to quiet or static loads, the material is not strained beyond 33 per cent of its strength; that is to say, the parts are made not less than three times as strong as is necessary to bear the greatest stress that will be put upon them.

We cannot calculate the maximum stresses of a bicycle with the nicety with which they can be computed in engineering structures and in the heavier classes of machinery. The conditions of use and abuse are so various—the hard use of a powerful but cautious rider being less severe than the abuse of some reckless boy—that the only way in which the proper strength for a wheel can be determined is by trial, and by a careful selection and test of the materials of which it is constructed. If an engineer were told to work out the strain-sheet of a bicycle in the same way as he would that of a railway bridge, taking the possible maximum stresses due to the work of heavy and powerful riders upon rough and hilly roads, and proportioning his parts so that the metal should not be strained above 10,000 to 15,000 pounds to the square inch, the wheel built from such a strain-sheet would be as heavy as the primitive boneshaker of thirty years ago.

A comparison of the bicycle considered as a means of transportation with a railway car brings out the remarkable fact that it takes forty-six times as much dead weight of material to carry a man on the railway as it does on a wheel. For a modern coach carrying sixty people will weigh about 70,000 pounds, which is at the rate of 1,167 pounds to the passenger; while a modern bicycle will weigh only 25 pounds. If we take the Pullman car as an example, the disparity is yet more striking; for here we have only twenty-four passengers carried on a car weighing 100,000 pounds, or say 2 tons to the passenger. In this case the car weighs 167 times more per passenger than does the bicycle.

From these considerations it is evident that the light weight of the bicycle can only be maintained by the most careful inspection of materials and workmanship, and in the case of all the standard bicycles it is safe to say that this inspection is very carefully made. Every lot of stock is subject to tests in the testing department, which, by the way, is coming to be recognized as an indispensable part of all large American establishments in the engineering and kindred trades, and the finished parts and finished machines are in some cases put to special tests to determine their strength and running qualities.

We present an illustration of one of many testing machines installed in the laboratory of the Pope Manufacturing Company. It is used for trying the strength of the frame, and it is designed to reproduce as far as possible the actual stresses to which a frame is subjected when put to hard usage on the road. The principal stresses are those due to the weight of the rider applied at the top of the seat-post tube and the alternate transverse bending stress due to the pressure on the pedals. The frame is mounted upon two blocks, one under each hub as shown, the crank-hanger being left unsupported. The stresses due to the weight of the rider are reproduced by means of a short-throw crank driven by a pulley, and a spring connecting rod, as shown, one end of which is clamped to the seat-post, while the crank engages a sliding head which is attached by a powerful spiral spring to the other end. The rapid rotation of the crank thus imparts a series of cushioned blows whose effect on the frame is similar to that due to the speed of the machine, inequalities of the road, the pneumatic tires, and that part of the rider's weight which is on the saddle.



MACHINE FOR TESTING BICYCLE FRAMES.

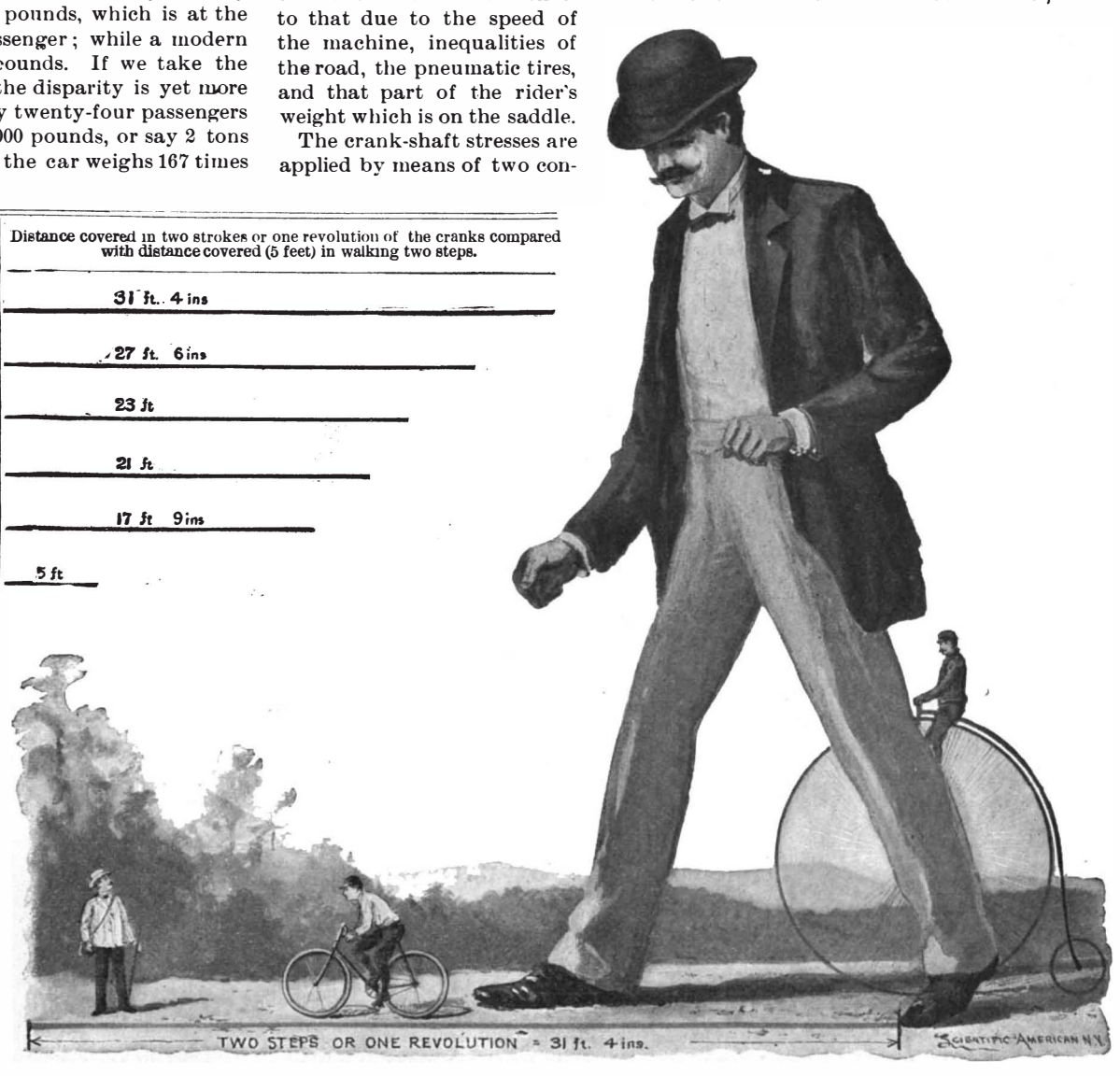
The crank-shaft stresses are applied by means of two connecting rods, one on each side of the frame, which are driven by eccentrics set at 180° and carried on a second pulley-driven shaft. The stroke of the eccentrics is of course very short, merely sufficient to bring a heavy bending stress alternately on each side of the crank-hanger. One machine out of every lot is placed in this instrument of torture, and if, after it has been merrily thumped and wrenched for a stated length of time, its tubing is true, brazing sound, and the whole frame in line, it is considered that no fair usage on the road can ever break or distort it.

One must confess that, interesting as the various departments of a bicycle factory undoubtedly are, the most fascinating plant is to be found in the department of tests, for here we see the fruition of the labor of the whole establishment. That all-absorbing question as to the respective ease of running of a chain and a chainless wheel is here determined to absolute demonstration on an ingenious device known as a float dynamometer. The wheel is mounted at the side of a tank of water in which are two separate floating platforms. On the first platform is mounted an electric motor, on the other a friction brake. The motor is connected by a universal joint shaft with the axle of the bicycle, and the friction brake is similarly connected with the shaft of a pulley upon which the rear or driving wheel of the bicycle runs. It is evident that the power given out by the floating motor will be in part absorbed by the internal resistance of the bicycle, the rest being returned at the floating brake.

The tangential reaction of the motor will cause the float on which it is carried to tilt over; similarly, the pull of the brake will tilt the brake float. If, now, the tilting in each case be corrected by moving a sliding weight on a horizontal graduated arm, the readings of the two arms will show respectively the power given to the bicycle by the motor and the power returned to the brake from the bicycle. The difference will represent the loss by friction in the bicycle. If a chainless and a chain wheel be tested in the same apparatus, their respective efficiency can be determined with the greatest accuracy.

It is found that, with the gears new and perfectly clean under light loads, there is practically no difference in efficiency between the Columbia chain and chainless wheels, but, as the load is increased, the chainless wheel begins to show a gain which grows rapidly as the load is still further augmented—a result which shows the bevel gear to be superior to the chain gear for hill climbing, and superior to it in all cases where the chain has "stretched" or is fouled with grit or dust.

Size of gear.	Gear used for	Distance covered in two strokes or one revolution of the cranks compared with distance covered (5 feet) in walking two steps.
120	Paced racing	31 ft. 4 ins
105	High gear for road riding	27 ft. 6 ins
88	Sprint racing	23 ft
80	Ordinary gear for road riding.	21 ft
68	Lady's wheel	17 ft 9 ins
Two steps	Walking	5 ft



BICYCLE GEAR AND ITS EQUIVALENTS.

A safety geared to 120, in one revolution of the crank, covers the same distance as that covered by one revolution of an ordinary wheel ten feet high, or two strides of a man thirty-five feet high.

BICYCLE GEAR—WHAT IT IS AND WHAT IT DOES.

Those of our readers who were bicycle enthusiasts in the days of the old "ordinary" will remember that a wheel was designated by the diameter, in inches, of its driving wheel, which varied from 48 to 62 inches, according to the length of leg of the rider. Thus we were wont to speak of the respective merits of our 50-inch Rudge, or 54-inch Victor, or 60-inch Columbia, as the case might be. The diameter of the driving wheel was the most variable element, and hence it was chosen as the designating feature.

With the introduction of the rear-driven safety it was no longer possible to grade the wheels according to the diameter of the

© 1899 SCIENTIFIC AMERICAN, INC.

driving wheel, for the reason that the latter all settled down to a common size of 28 inches; but as the introduction of the chain drive enabled the speed of revolution of the driving wheel to be increased over that of the cranks, thereby increasing its circumferential speed, it was decided to designate the bicycle by the effective diameter of the rear wheel as thus secured. The increased circumferential speed of the wheel is obtained by placing a larger sprocket on the crank axle than on the rear wheel; for the rear sprocket (with its wheel) will run just as much faster as the front sprocket is larger than itself. Thus, if there are 24 teeth in the front sprocket and 8 in the rear, it is evident that, by the time the 24 teeth of the front sprocket have engaged and drawn forward the chain, the chain will have engaged and drawn forward 24 teeth on the rear sprocket, and to do this it must have rotated the 8-tooth rear sprocket three times. Now, this will cause the 28-inch rear wheel to travel over a distance equal to three times its own circumference, or equal to the single circumference of a wheel three times as large as itself, or 84 inches in diameter. Since this effective diameter is due to the chain and sprockets, it is spoken of as "gear," and a bicycle with an effective driving wheel diameter of 84 inches is known as an 84-gear wheel.

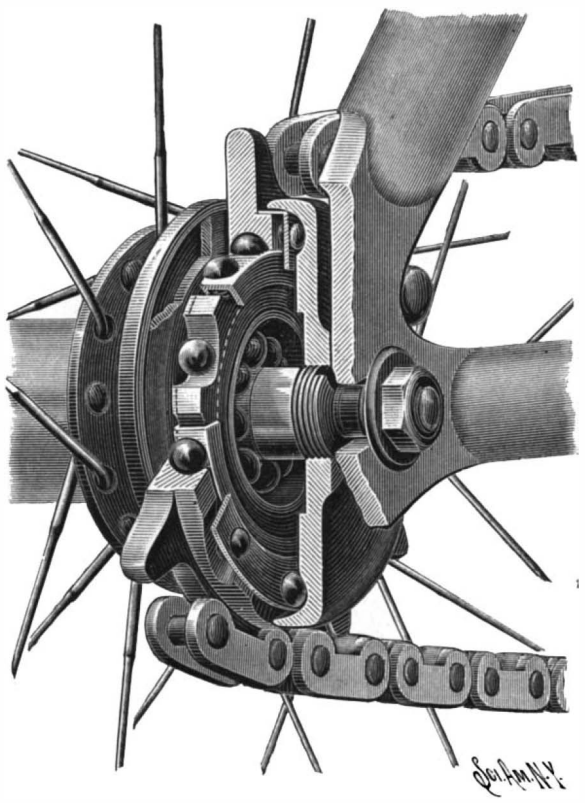
It is evident, then, that since the diameter of the rear wheel is constant, the gear depends solely upon the relative size of the sprockets employed, and is found by the simple formula, $G = \frac{D \times F}{R}$, where G = the gear; D the diameter (28 inches) of the rear wheel; F the number of teeth in front sprocket and R the number of teeth in rear sprocket. Thus 84 gear can be obtained by a 21-tooth front and a 7-tooth rear or a 30-tooth front and 10 tooth rear. The gear of a bicycle, then, is the diameter of a circle whose circumferential length is equal to the distance traveled by that bicycle in one revolution of the cranks.

It is largely the possibilities of "gear" that make the safety so incomparably superior to the ordinary bicycle. Formerly one was restricted to what he could stretch, and only a tall man could negotiate a 60-inch wheel. Now a child's wheel is geared to 60, and many women are riding wheels of 76 to 84 gear. Gears of 96 to 105 are not infrequently met with on the road, and there is one famous rider in paced races who has won his reputation on a wheel geared to 120 inches. It is the great distance covered in proportion to the speed of pedaling that constitutes the charm of the high gear, at least as far as the imagination is concerned; for that frailty of human nature which expresses itself in a desire to get "something for nothing" will not down, and asserts itself in all kinds of places and at unexpected times. In riding a high gear there is a sense of getting out of the machine something more than we put in—even though mechanical orthodoxy tells us this cannot be—and there is no denying that, under favorable conditions of grade and wind, a day's journey can be made with less fatigue on a high than a low gear.

Of course, we all know that the total work done by a rider in propelling the same wheel over the same stretch of road, under identical conditions, never varies, whatever may be the gear employed. If I ride a 25-pound wheel a mile on the turnpike with a gear of 60, I do a certain amount of work; and if I ride the same wheel over the same mile in the same time with 120 gear, I do the same amount of work. In the latter case I turn my cranks more slowly, but I have to exert just as much more pressure upon them as their speed of rotation has decreased. If, with a view to reducing the pressure, I double the length of the cranks, then my feet must travel twice as far in a circle twice as large. Since work at the cranks may be regarded as pressure multiplied by distance, the total amount of work I do will be the same, whether I exert heavy pressure on short cranks moving in a small circle or light pressure on long cranks moving in a large circle.

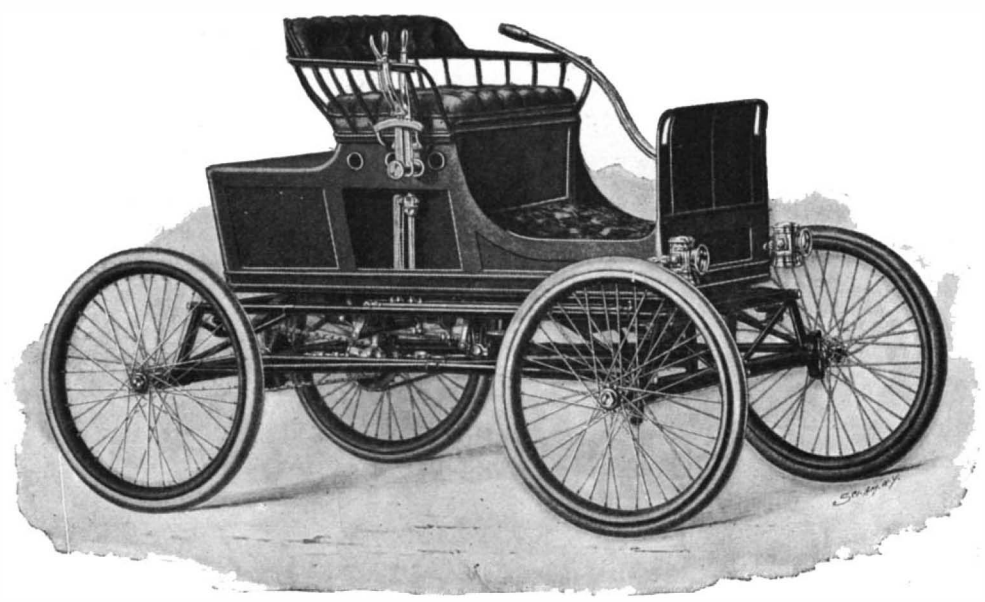
Since in riding the same distance at the same speed, on the same wheel, the total work is the same, whatever the gear and whatever the length of the cranks, the question arises, What is the best gear to use? The answer is that, The gear must be determined by the physical and temperamental make-up of each individual rider. If we were to pick out a dozen men, and start them out to walk a hundred yards, we would find that no two of them took the same length of step. Some would fall into a long swinging stride of 36 to 40 inches, while others would trot along with little mincing steps of 18 to 24 inches. The speed might be the same, but the length of stride would be that which each individual had unconsciously found to be agreeable to his own idiosyncrasies of physique and temperament. So with the question of gear and crank length. Some riders will get the best results with high gear and long cranks, others with low gear and short cranks, while a rider of the writer's acquaintance uses on the road a 104 gear with a 6½ crank, and will ride all day without any apparent distress. As a rule, tall men should use high gears and long cranks, a 6-foot rider being able to negotiate a 7½-inch crank with as little bending of the knee (a fruitful source of weariness) as a 5½-foot rider using a 6½ crank.

Our artist has shown in the accompanying sketch



THE TREBERT COASTER AND BRAKE.

how the gear increases the effective diameter of the driving wheel, raising it from 28 inches to as much as 120 inches in the case of one rider already mentioned. As a matter of fact, our fastest racing men are using a wheel from 2 to 3 feet larger than the largest locomotive driving wheels used in this country. Another interesting point brought out in the sketch is that the modern bicycle has increased the locomotive powers of man to such an extent that to cover as much ground at each step in walking as he does at each stroke of his pedals, he would have to be a giant fully 35 feet in height. It was found, by measuring the number of steps taken by several employes in walking 150 feet down the Scientific American office, that the average stride is 2½ feet in length, or 5 feet for two steps. Now two "strokes" of the legs of a cyclist on a 120 gear wheel would carry him a distance of 31⅓ feet; and, supposing the step is roughly proportionate to the height, our giant would have to be about 35 feet tall, and to make the maximum speed of between 35 and 40 miles an hour accomplished on the 120-gear wheel, he would have to step as frequently as a person of ordinary stature walking at a brisk rate.



THE VICTOR AUTOMOBILE CARRIAGE.

A French firm has undertaken the manufacture of a new metallic curtain for the Opera House at Besançon. The curtain is to be lowered after each act or in case of great danger. It is 60 feet wide and 54 feet high and is to be composed of aluminum sheets 13 feet long and 29 inches wide and $\frac{1}{12}$ of an inch thick. The total weight will be 4,000 pounds. If such a curtain were made of sheet iron, it would weigh 11,000 pounds.

THE TREBERT COASTER AND BRAKE.

Since the introduction of the automatic coaster and brake, improvements in construction have constantly been made which have increased the efficiency of the device to such an extent that the old plunger brake is beginning to disappear. Among the latest types of these brakes is the Trebert brake, made by the Trebert Automatic Coaster and Brake Co., of Syracuse, N. Y.

The brake in question comprises essentially a friction-disk secured to the hub of the rear wheel, a clutch on the disk, and a clutch on the rear sprocket-wheel. The two clutches are provided with inclined surfaces upon which balls, held in place by retaining rings, roll. The balls on the disk-clutch serve to lock the sprocket and clutch together when the wheel is in motion; and the balls on the sprocket clutch serve to bind the sprocket against the friction-disk in order to stop the wheel.

When the chain of the bicycle is pulling forward, the balls on the disk-clutch will also move forward and ride up their inclines, thereby locking the clutch and sprocket together so that both rotate with the wheel. When the rider desires to coast, he applies a slight back pressure to the pedals, thus causing the balls on the disk-clutch to roll down their inclines in order to release the sprocket from the clutch and to permit the wheel to rotate independently. When the rider wishes to stop, he applies a further back-pressure to the pedals, thereby causing the balls on the sprocket clutch to ride up their inclines and to bind the sprocket and friction disk so tightly together that the wheel is prevented from turning.

The brake, besides giving the rider full command of his wheel and enabling him to hold his feet stationary upon the pedals for the purpose of coasting, possesses the additional advantage of being readily applied to any wheel without the necessity of remodeling or changing the frame.

THE VICTOR AUTOMOBILE.

While we are considering hydrocarbon and electric vehicles, it must not be forgotten that there are also on the market excellent motor carriages driven by steam, and we take pleasure in presenting an engraving of the "Victor automobile," which is a steam wagon entirely automatic in its regulation, made by the Overman Wheel Co., Chicopee Falls, Mass. When the word steam is used it naturally brings to mind a certain uneasiness, but users of the Victor automobile need have no anxiety, for the boilers are tested and insured by the Hartford Steam Boiler Insurance Company, each boiler being tested by the expert of this well known company and a certificate given as to the test. The boiler is truly automatic, the water being fed into the boiler automatically with absolute precision. Thus the user will be relieved from the point which is the chief difficulty of putting steam in the hands of laymen. The pressure on the fuel tank is also regulated automatically. The fuel tank holds enough common gasoline to go fifty to one hundred miles, and gasoline is readily obtainable in every village. It also holds water enough to run twenty-five miles, and a collapsible soft rubber bucket enables one to get water at any place. The engines are of three and one-half horse power and the boiler capacity is five horse power. The machine is geared according to the roads and hills, and it is capable of running from a speed which is slower than one would walk to its maximum speed, which would ordinarily be about twenty miles an hour.

Infection by Speaking Tubes.

The speaking tube is an excellent means of infection, and The London Lancet has recently issued a note of warning concerning them. These tubes are practically unventilated except when in use, and when the person using them speaks, the moisture in the air which he exhales condenses on the sides of the tube, so that the products of respiration remain for the benefit of the next persons using the tube; and it is little wonder that the telephone is recommended in preference to the speaking tube by sanitarians. It is quite possible for tuberculosis or other diseases to be spread by speaking tubes; for it is necessary for the person in calling to place his lips in actual contact with the mouthpiece at the near end to make the whistle sound at the far end.

Tunnels under the Thames at London are multiplying rapidly. Hardly has the Blackwall tunnel been open when another at Rotherhithe is projected. It is to be 30 feet in diameter—3 feet more than the Blackwall tunnel. It is to be a mile and a quarter long. The total work will cost about $7,000,000, but nearly $4,000,000 of this will go for the approaches.

© 1899 SCIENTIFIC AMERICAN, INC.

The Cyclist without a....

ACTUAL SIZE.

Price, **$1.** 10,000 miles and repeat. **Dust-proof, water-proof, positive action.** Parts cannot become disarranged. Cannot register falsely unless actually **broken.** No springs. No delicate parts.

Veeder

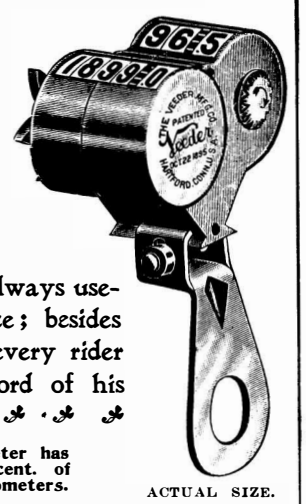
Cyclometer is almost as much "at sea" as the ship without a log. It gives accurate information of distance traveled that is always useful and often of vital importance; besides the constant satisfaction that every rider finds in reading the exact record of his cycling achievements.

The merit of the Veeder Cyclometer has eliminated competition. 90 per cent. of modern cyclometers are Veeder Cyclometers.

BOOKLETS FREE.

VEEDER MFG. CO.,

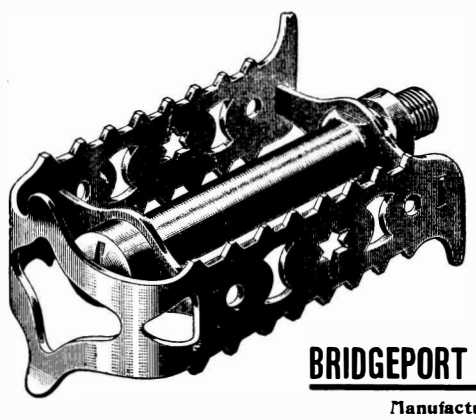
Hartford, Ct.



ACTUAL SIZE.

"Trip" Cyclometer. Price, **$2.** The small indicator can be set back to zero, **like a stem-setting watch,** after each trip, without affecting grand total on the large register. Same positive action as the other famous model.

Star Pedals



have not been changed in style of construction in over four seasons!

DEMAND them upon your Wheel, and you will obtain a pedal of

The Best Possible Finish, Strength, Grace & Lightness

BRIDGEPORT PEDALS ARE ALSO HIGH GRADE.

Manufactured by

The Bridgeport Gun Implement Co.

Factory: Bridgeport, Conn. 313-315 Broadway, New York City

Bicycle and Automobile Lamps

And all Other Types of

Miniature, Decorative, Candelabra and Battery Lamps.

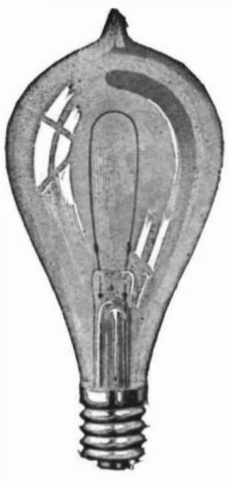
We are supplying the Largest Manufacturers with Bicycle and Automobile Incandescent Lamps. Our latest Catalogue is No. 1017.

We also Manufacture large quantities of

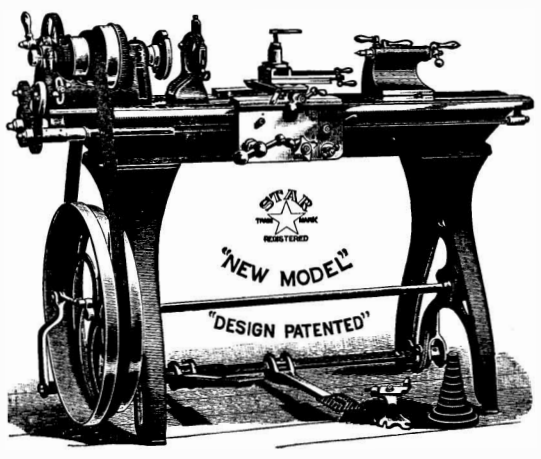
X-Ray Tubes and Fluoroscopes

of the Finest Quality. Catalogue No. 9050.

EDISON
DECORATIVE AND MINIATURE LAMP DEPT.
(GENERAL ELECTRIC CO.),
HARRISON, N. J.



STAR FOOT AND POWER LATHES



9 AND 11 INCH SWING.

Complete Screw-Cutting Engine Lathes.

With Automatic Cross Feed, with either Plain or Compound Rest, U. S. Standard, Whitworth or Metric Lead Screws.

Heavy, rigid, accurate, correct in design and highly finished, combining throughout the best material with the highest class of workmanship.

Suitable for Electrical and Bicycle Work, Tool-Makers and Gunsmiths, Technical Schools and fine, accurate machine shop service.

☞ *Send for catalogue B.*

THE SENECA FALLS MFG. CO.

416 Water Street, SENECA FALLS, N. Y., U. S. A.

Waltham Watches.

Everyone awheel or afoot should carry a Waltham Watch—the most accurate machine for keeping time it is possible to make.

"The Perfected American Watch,"

an illustrated book of interesting information about watches, sent free on request.

American Waltham Watch Company

Waltham, Mass.

"PERFECTION"

Air Mattresses

and Pillows are a boon to everybody; especially to invalids and the bedridden.

This Trade-Mark on all our Air Goods is a guarantee of quality. PERFECTION TRADE MARK *Catalogue FREE.*

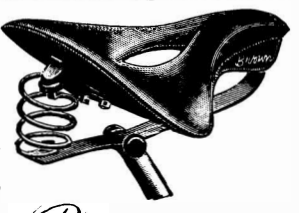
Mechanical Fabric Co., Sprague St., Prov., R. I.

"PERFECTION"

Air Cushions

Are simply delightful FOR THE PIAZZA, PARLOR, YACHT, CANOE, Etc.

There are a great many Brown Type saddles on the market, but only one genuine *Brown* Saddle



BOOKLET FREE ON APPLICATION.

THE BROWN SADDLE COMPANY, ELYRIA, OHIO.

$2.00 inclosed with this ad. entitles you to this beautiful **$3.50** Rubber-Neck Saddle.

The Bunker Saddle Co., Chicago, Ill.

BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT 1123. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for 1897 catalogue.

Elgin Watches,

by their superior construction, insuring endurance and accurate time-telling under all conditions of temperature, position and railway service, are recognized universally as

The World's Standard.

They come in various sizes, for men, women and youth, encased to suit every taste. An **Elgin** watch always has the word **"Elgin"** engraved on the works. Fully guaranteed.

A "Book about Watches" is sent free to all who write for it.

ELGIN NATIONAL WATCH COMPANY, - - - Elgin, Ill.

© 1899 SCIENTIFIC AMERICAN, INC.

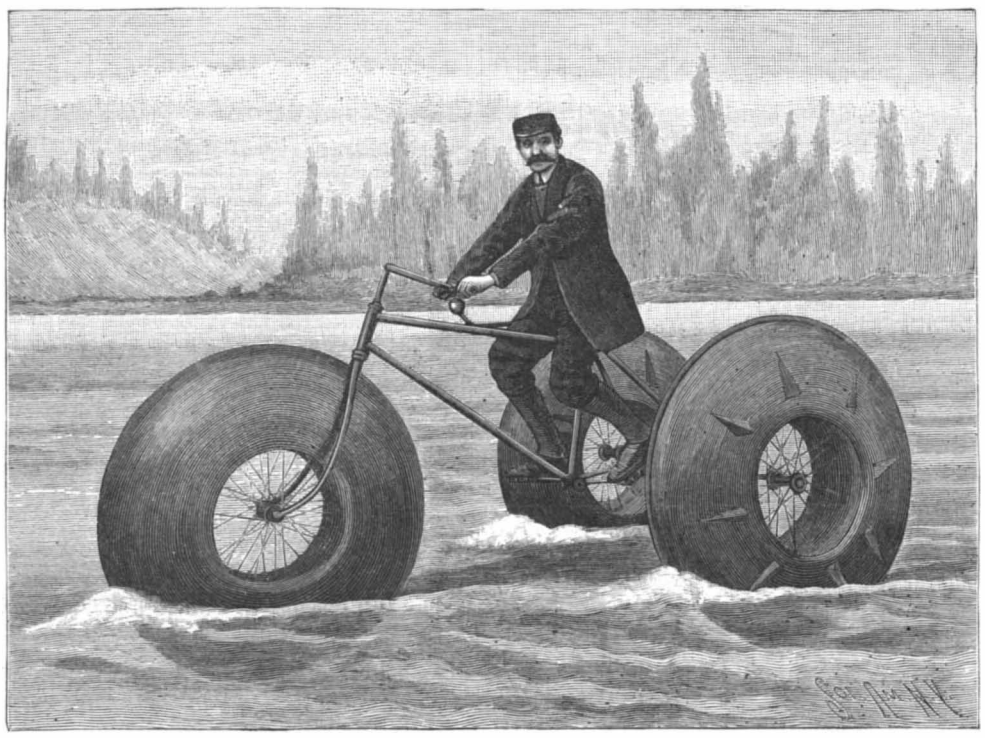
AN AMPHIBIOUS TRICYCLE.

The "Amphibie" is the name M. Theodorides has christened his new nautico-terrestrial tricycle, which we illustrate herewith, and which has recently been tried in France.

The tricycle is constructed entirely of aluminum, with the exception of the chain and certain other parts which require the use of steel. The wheels have enormous inflated rubber tires, which give them a diameter of 3·83 feet, and which make each wheel a water-tight float, buoying up the machine on the water.

The tricycle can be used indiscriminately on land or water, and although it does not run very rapidly, it may be of considerable use in special cases.

It weighs but 66 pounds and sinks, when fully loaded, to a depth of only 12¾ inches. Our engraving shows very well the appearance of this curious machine while navigating on the water.



AN AMPHIBIOUS TRICYCLE.

Cheap Cab Service in New York.

The General Carriage Company, of New York, is to be incorporated for the purpose of constructing and maintaining hacks or other vehicles for hire on the public roads, streets, or highways of cities of the first class, which, of course, means New York and Buffalo. The corporation has the right to establish the time service and the distance service, and to subdivide the latter into a mileage and circuit service. It can charge rates of fare not exceeding 75 cents an hour for each person in the time service, and not to exceed 25 cents per mile for each person for the mileage service, and not to exceed 25 cents a person on the circuit service. It is proposed to establish cheap cab service such as now exists in London and Paris. There is a great field for cheap cabs in New York city, and the electric vehicles which have been in operation there for a long time have won a deserved popularity.

At the sale of the Morrison cameos in London, a Greek gold ring from Tarsus with an intaglio of Bacchus was sold for $1,150. Another ring with the figure of Bacchus brought $925. The signet of Asander, King of the Bosphorus, from Kertch, brought $2,300.

Lord Charles Beresford and Automobile Cabs.

Lord Charles Beresford in his recent trip to America pointed out how much Great Britain is behind the times in the use of electricity. He was amazed to see how much work was done by electricity on board American warships where the English use steam. He is a warm advocate of automobile cabs. He attributed the congestion of London streets to the use of horses. He said, "While I was in New York I was supplied with a motor car which had the appearance of a cab and the manners of a kangaroo, but it always got me safely to my destination."

The Building Edition for May.

The Building Edition for May is a beautiful number and its contents are more than usually diversified. A residence at Newark, N. J., forms the subject of the colored cover. It is a handsome brick colonial house built by Messrs. McKim, Mead & White. There are also a number of fine interior views of this house. The stable for the same residence represents a unique treatment of a problem which is often neglected. There are a number of other interesting houses illustrated. The literary contents are fully up to the usual standard, the editorials being "An Architectural Symposium," "Equestrian Statues," "What to Do With Our Backyards," and "Architectural Education in the United States." There is also an excellent example of an old colonial doorway, reproduced from a measured drawing, and also an interior view of the Cathedral of Münster and the plan of the Palace at Düsseldorf.

The Current Supplement.

The current Supplement, No. 1219, has many articles of great interest. The University of Pennsylvania Lecture Course is represented by the second part of Dr. Herman V. Ames' "Peculiar Laws and Customs in the American Colonies," which is concluded. "Wireless Telegraphy" is represented by an article which describes the Ducretet system. The usual notes and consular matter is published. "The Alkali Soils of the Yellowstone Valley" describes some very interesting investigations which have been carried on by the United States Department of Agriculture, in the interests of the inhabitants of this valley. "Electric Traction and its Application to Suburban and Metropolitan Railways," by Philip Dawson, is an important and exhaustive paper on the subject. "The Intelligence of Tropical Ants" is a most attractive paper by Dr. Eugene Murray-Aaron.

Contents.

(Illustrated articles are marked with an asterisk.)

Automobile, early forms*	296	Electrical Exhibition notes	301
Automobilism in Paris	293	Firemen, bicycle for	297
Bicycle, charm of	292	Gun, explosion of*	305
Bicycle gear*	309	Indiana motor carriages*	308
Bicycle, history of*	298	Inventions recently patented	312
Bicycle records	292	Locomotives for England	295
Bicycle riding backward*	303	Notes and queries	315
Bicycle support*	297	Orion, nebula of*	302
Bicycle, tests of Columbia*	309	Patent, early forms of*	300
Cab service in New York	312	Path for cyclists	296
Chain cleaner*	297	Peary relief expedition	295
Columbia motor carriages*	304	Pedal, stirrup*	297
Coaster brake, Trebert*	310	Riker motor vehicle*	291, 295
Cruiser, fastest	292	Trick riding*	298, 299
Cyclist, consulting	294	Tricycle, amphibious*	312
Cyclometers, mounting for*	297	Victor automobile*	310
Decauville motor carriage*	306	Winton motor carriages*	300
Defenses, sea coast	292	Woods' electric motor vehicles*	294

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

HARROW. — William M. Baker, Fortville, Ind. This harrow employs a series of revolving teeth in connection with rollers, the teeth being so mounted that, should one of them be broken, another may be readily substituted therefor. The depth to which the teeth may enter the ground may be regulated by plain rollers which are carried by hanger-arms. The adjustment of the hanger-arms regulates the depth to which the teeth enter the soil.

Bicycle-Appliances.

BICYCLE-SUPPORT.—Burr Hubbell, Kelly's Corners, N. Y. The support has a column on which a body portion is mounted, provided with laterally-projecting lugs. A jaw is pivoted on the body-portion between the lugs, and, when drawn toward the body-portion, clamps the frame of the bicycle. A fork is attached to the body portion and engages the front wheel of the bicycle; and an arm held by the body portion engages the saddle-post tube.

SADDLE.—Frederick C. Avery, 6104 Butler Street, Chicago, Ill. The object of this invention is to provide a saddle in which the seat will sustain all the weight and the horn no part of the weight. The horn is supported by an independent spring, and is made separate from the seat portion. The pommel-spring is attached to the middle plate adjustably; and the same bolt which secures the rear end of the pommel-spring also secures the front end of the seat-support connection. The saddle-cover not only covers the seat and extends forward to form the horn, but also lies over the sides of the saddle. If it be so desired, removable pads can be used between the seat portion and seat cover.

Electrical Apparatus.

TELEPHONE-TRANSMITTER.—Edward H. Johnson, Omaha, Neb. The transmitter devised by this inventor is designed to multiply the sound-impulses against the diaphragm so that they may be increased in the receiver. The transmitter comprises a diaphragm against which a ring of resilient material, a series of contacts on the ring, and another series of contacts with which the first-named contacts engage. The vibrations of the diaphragm will set the several rings in equal vibration; and the impulses will be greatly multiplied through the contacts.

Engineering-Improvements.

VALVE-OPERATING GEAR.—Austin H. Krauss, Wymore, Neb. Upon the engine-shaft a hub is secured having flanges, one of which is provided with a slot, extending diametrically. To the other two flanges a plate is fastened, which is provided with a slot controlling the position of the eccentric. The principal feature of the invention lies in the form of this slot, which is neither straight nor the arc of a circle. The slot is divided into three parts, the central one of which is straight and the end portions curved. By means of this slot the eccentric may be adjusted to give the valve the desired lead for any amount of travel.

Mechanical Devices.

FOLDING AND CREASING MACHINE.—John F. and James A. Cameron, Brooklyn, New York city. This invention provides a machine for folding, creasing, and cutting cloth into handkerchiefs before or after stitching. The machine is designed to take a bolt of cloth and to turn both edges over simultaneously, so as to form the folds necessary for stretching the edges, and to cut one edge so that it may be torn into designated lengths. The machine comprises folding-guides adapted to engage and fold the side edges of the handkerchief stock. A supporting-plate, which is cut away between the guides, permits the center of the stock to drop between them. Rollers engage and compress the folded edges of the stock.

CRANE.—Alexander Grafton, Bedford, England. This crane is provided with a so-called "derrick-motion," for varying the radius of the crane by varying the vertical angle of the jib. The improvement devised by the inventor consists in a means for indicating the radius and the load which may be safely carried at that radius. The means consist in the combination of the jib-adjusting gear with a dial and index, one of which is carried by a rotatable axis in gear with the chain-barrel or pulley, so as to be revolved thereby, the gearing being so proportioned that the rotary part will make less than one revolution for the maximum number of revolutions of the barrel or pulley required for adjusting the jib between the extreme limits employed in practice.

Railway-Contrivances.

BOLSTER FOR LOGGING-CAR FRAMES.—Surry Parker, Pinetown, N. C. The bolster is provided with a standard movable on the bolster, extending above the surface thereof when in use, and below the top surface and out of way when loading or unloading. A retaining device holds the standard on the bolster, guides it in its up-and-down movement, and limits the sliding movement. The standards always remain on the bolsters, and can be readily lifted into an extended position and locked to retain the logs, or released to permit the lowering of the standards for loading or unloading the logs.

Miscellaneous Inventions.

ACETYLENE GAS GENERATOR.—John Carlson, Mandan, N. D. In this machine an ordinary bell-gasometer floating in a water-tank is used in connection with a generator. A valve-controlled pipe connects the water-tank with the generator, the valve being held normally closed by a lever. An arm is pivoted upon the bell and is adapted to engage the lever to open the valve when the bell descends, in order to permit more water to reach the carbid, and thus generate a new supply of gas.

DISPLAY-RACK. — John B. Crowder, Talucah, Ala. This improved display-rack is especially intended for holding nails, brooms and tinware, and is provided with an upright or post having upper and lower rings. Nail-boxes furnished with broom-holders, are seated at their lower ends on the lower ring and have hooks engaging the upper ring. On the post, above the upper ring, a tin-holding frame is mounted.

APPARATUS FOR SEPARATING AND RECOVERING VALUABLE VAPORS.—James R. Whiting, Stamford, Conn., and William A. Lawrence, Waterville, N. Y. In the separation of air from the hydrocarbons known as the "lighter products of petroleum," while they are in a vaporous state, valuable products are lost by mixture with air. The inventor of the present process prevents this loss by employing a series of cooling-tanks and vapor-collectors by means of which the loss of the volatile products is prevented. These products, it is said, are recovered not only without detriment to the previous operation of evaporation and condensation, but assistance is rendered to the previous operations by removing from them all back pressure of this vapor.

CLOTHES-PIN. — Melvin E. Thomson, Clermont, Penn. By means of the clothes-pin devised by this inventor, it is possible to secure the clothes without fastening them directly upon the line. A wire structure is employed having at its top a hook, and at its bottom clamping devices by which to engage and removably hold the clothes.

WATER-FILTER.—Samuel M. Suman, Riverside, Cal. The water filter comprises a series of filter-beds, each having an inlet at the bottom and an overflow at the top. Between adjacent filter-beds, charcoal-receptacles are arranged to receive the water from one filter-bed and to deliver it to the inlet of the next following filter-bed, each charcoal-receptacle being provided with a top portion over which the water flows. The filter is designed to be used in dwellings, hotels, soldiers' barracks, and miners' camps.

FIREPROOF STRUCTURE. — George Spricker-hoff, Manhattan, New York city. The present invention provides a fireproof structure such as a floor or ceiling, which structure is light, yet strong. The structure consists of beams to which stirrups are attached. Supporting-strips are sustained by opposite stirrups; and tie-rods are extended through openings in the strips. To the tie-rods a netting is secured which forms a support for a fireproof cement or concrete, filling the space between the netting and the top of the beams. The structure, besides being strong and light, has the merit of being readily put in place.

SUSPENDER-BUCKLE.—Max Rubin, Manhattan, New York city. The buckle comprises two U-shaped sections pivoted together to form a loop, the other ends of the sections overlapping each other. Each of these ends is formed with a jaw. A spring engages the sections to hold the jaws in clamping position. The jaws hold the suspender-tips and are capable of being separated by a pressure upon the body of the buckle, and of being automatically restored to locking position by the spring.

WIND-WHEEL. — Oren Rubarts, Newport, Ore. This wind-wheel is provided with a turn-table from which arms extend in opposite directions. A vane is mounted on one of the arms, and a shaft is mounted in bearings on the other of the arms. To the outer end of the shaft a hub is fixed, on which blades move axially. On the shaft a governor-disk connected with the blades is mounted to slide. A governor-rod has connection with the disk and is mounted to slide on the arm supporting the shaft. On the turn-table a pulley is supported, over which a chain extends, connecting with the rod forward of the pulley. Another chain extends over the pulley and connects with the rod rearward of the pulley. A balancing weight is adapted for connection with either of the chains. By increasing or decreasing the weight, the speed or power transmitted can be increased or decreased.

CLARINET. — Gustav L. Penzel and Edward Müller, Manhattan, New York city. The G-sharp key in this clarinet consists of a pivoted finger-piece formed with a rearward extension and a key proper having a connection with the finger-piece whereby it will open when the finger-piece is depressed, but will move independently of the finger-piece when the latter is depressed. A trilling-lever actuated from the key F-sharp is arranged to engage with the key G-sharp proper in order to trill that key when the finger-piece is depressed. Keys B-natural and C-sharp provided with finger-pieces, lie over the rearward extension of the finger-piece of the key G-sharp, whereby the key G-sharp may be trilled when either of the B-natural or C-sharp finger-pieces is depressed.

BREAST-SHIELD.—Ebenzer Murray, Deadwood, S. D. The breast-shield comprises two cup-shaped breast-covers having diametrically opposite, horizontal tabs in line with their centers. A cap is hinged to each cover at the side of the aperture. A body-strap connects the outer tabs; and shoulder-straps connect the body-band with the breast-covers.

FURNACE-ATTACHMENT.—George M. Lindsay and George Saunders, Andover, Mass. The object of this invention is to provide a simple attachment by the use of which all cold air will be drawn from the hot air flue by the furnace-draft, the same draft serving to force the hot air through the flue, thus distributing the hot air uniformly. Connected with the hot air flue leading upwardly from the furnace, is a tube communicating with the interior of the flue on the lower side of a horizontally-disposed portion of the flue, and also with the furnace near the bottom.

VEHICLE-WHEEL. — William W. Kitchen, Rochester, N. Y. The wheel devised by this inventor com-

(Continued on page 315.)

© 1899 SCIENTIFIC AMERICAN, INC.

Going Abroad?

The pleasure and benefit of any journey by land or sea, of games, races, hunts, regattas, is enhanced by the use of a good glass. Of all Field, Marine, or Opera Glasses ever made, the

Bausch & Lomb-Zeiss

STEREO Glasses

are by far the best. Greater Field Power, Range and Stereoscopic effect Lighter, Smaller, more Convenient.

Booklet FREE.

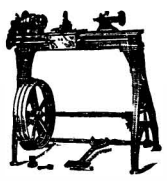
Photographic Catalogue on request.

MANUFACTURERS:

BAUSCH & LOMB OPTICAL CO., ROCHESTER, N. Y.

N. Y. Office: 25th and Broadway
CHICAGO: State and Washington.
BOSTON: 325 Washington.

OLD STYLE. BAUSCH & LOMB-ZEISS STEREO BINOCULARS.



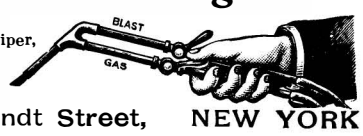
Do You Want a Bargain

in a Lathe? Superbly finished, Hollow Spindle, 10 inch swing. Complete with 6 inch 4-jaw Chuck jaws reversible, 6 Steell athe Tools, 2 Steel Dogs, Belt, Brass Oil Cups. List price, $97.50. **Our Cash Offer, $75.00** Send stamp for Illustrated List 834, showing how you can save up to 50 per cent. on all the tools you use.

Repair Bicycles for a Living.

EASY WAY TO MAKE A GOOD LIVING.

Bellows, Blowpipe, Vise, Files, Spokes, Pliers, Spoke Threader, Caliper, Cones, Repair Parts. Complete Outfits. Send 25 cents, in U. S. stamps, for illustrated treatise, "HOW TO REPAIR BICYCLES," by competent authorities, and a fully illustrated catalogue embracing thousands of bargains in Tools, Fittings, and Repair Parts.



THE FRASSE COMPANY, 38 Cortlandt Street, NEW YORK

OUTING

Treats of all the many Amateur Sports and Pastimes, and at this time of the year of Golf and Fishing in particular. The following articles are in the May number:

Golfing 'Round the Hub, by George H. Sargent, in which something of each of the twenty-nine links within a radius of twelve miles of Boston's City Hall is told.

The Challenge of the Shamrock, by Capt. A. J. Kenealy.

About Fly Casting, by Geo. E. Goodwin.

Angling for Eastern Trout, by Mary T. Townsend.

Golf—Interscholastic—The Metropolitan Handicap and Contests and Pacific Coast Golf.

Now on all first-class newsstands.

25 Cents per Copy. Three Dollars a Year.

Golfing 'Round About the Quaker City, by Hanson Hiss, will be published in June **OUTING,** which will also contain:

Through the Green with the Iron Clubs, by Findlay Douglas (amateur champion of the W. S.) An article of value to every man and woman who knows a niblick from a mashie.

Also,

Where the Quananiche are Waiting, by Ed. W. Sandys, which tells of fine fishing and hunting to be had in the wilderness north of Quebec.

The June issue will be published May 25th.

JULY OUTING will contain:

'Round and About Chicago with the Golfers, by Alexis J. Coleman, besides several fishing articles and golf records now in the hands of the illustrators.

The Golf of Gotham, by Charles Turner, is now being prepared for the August issue.

The whole form a series of Golf articles which are of decided value to golfers, and which are desirable for reference long after you have first read them.

In order to make sure of these four numbers, send $1.00 to your newsdealer or direct to the publishers. Better still, send $3.00 for a year's subscription.

Every number contains the best Golf articles and Fishing stories, besides articles on all the other sports.

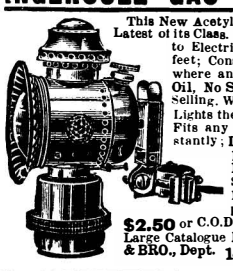
Every issue is beautifully illustrated by the best artists in this particular line.

The Outing Publishing Co.,

239-241 Fifth Ave., New York.

Twelve Months, $3.00
Four Months, $1.00

INGERSOLL GAS LAMP. $2.50



This New Acetylene Gas Lamp is the Best and Latest of its Class. Shows a White Light equal to Electricity, of Great Volume, 300 feet; Consumes Carbide; Sold Everywhere and by us at 20c. per lb. No Oil, No Smoke! The only Lamp now Selling. Will Never Blow or Jar Out and Lights the Whole Road for Rods Ahead; Fits any Part of Wheel; Detaches Instantly; LIGHTEST, 17 Oz.; SMALLEST, 7 In. High; PRETTIEST—see cut. All Nickel, No Solder; Our Price Saves You Nearly One-Half. Sent Prepaid by Express on Receipt of **$2.50** or C.O.D. if **50c.** is Sent with Order. Large Catalogue FREE. R. H. INGERSOLL & BRO., Dept. 147 67 Cortlandt St., N. Y. C.

PREVENTS RUST

Cleans, Lubricates

Used and recommended by Fire Arms Manufacturers.

3 in One OIL

is indispensable to the

GUNNER, CYCLIST, TYPEWRITER, ETC.

Ask your dealer for it. **Sample Bottle Free** on receipt of 2c. stamp.

G. W. COLE & CO., 139 Broadway, N. Y.

SATISFACTORY CARD PARTIES

are those where a good quality of card, having fine finish, good slip, handsome designs, and excellent wearing quality, is used. These qualities are all combined in the

GOLF PLAYING CARD

The Best 25 Cent Card Made.

Ask your dealer for them or send 25 cents to us for sample pack.

THE AMERICAN PLAYING CARD CO.,
Kalamazoo, Mich.

Haunts in the Wildwoods...

and Gay Places ..for Summer.. Outings.....

Either or both can be found along the lines of the.....

CHICAGO, MILWAUKEE AND ST. PAUL RAILWAY

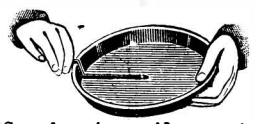
in Wisconsin, Minnesota, Northern Michigan, Iowa and the Dakotas.

AMONG the many delightful Summer Resorts are Delavan, Waukesha, Oconomowoc, Elkhart Lake, Marquette, Madison, Kilbourn, Minocqua, Star Lake, Lakes Okoboji, Spirit Lake, Clear Lake, Big Stone, Frontenac, White Bear and Lake Minnetonka.

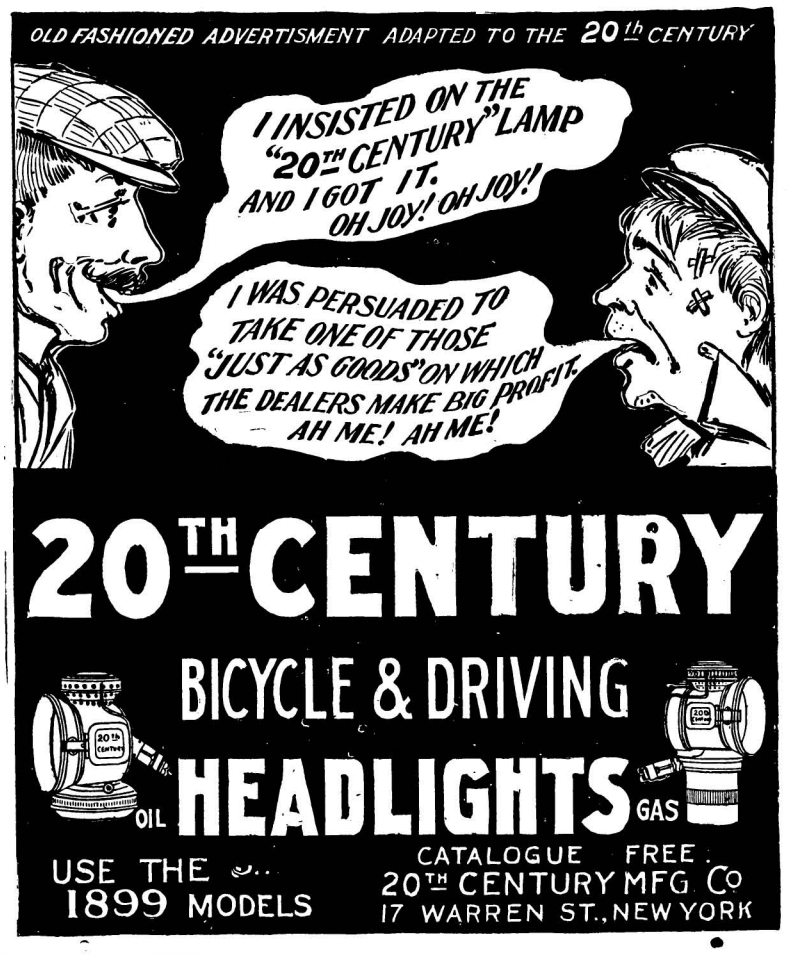
In the North Woods of Wisconsin, in the Forests of Northern Michigan and Minnesota, and in the far stretches of the Dakotas, true sportsmen can fish and hunt to their hearts' content.

For pamphlet of "Summer Tours," "Fishing and Hunting," apply to nearest ticket agent or address with two cent stamp, **GEO. H. HEAFFORD, Gen'l Pass. Agt., 555 Old Colony Building, Chicago, Ills.**

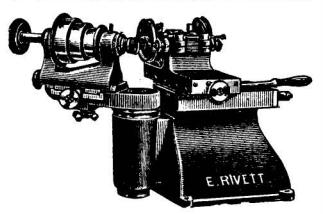
The "Clean Cut" Cake Tin



prevents cakes from **sticking** and produces a perfect cake. It is made of best quality tin with a flat, thin knife, securely riveted in center and at rim. Simple and durable. Sample sent prepaid on receipt of **15c.** Agents send 6 cents postage for **free** sample. We are the largest manufacturers of **Pure Aluminum, Scotch Granite and Tin Ware** in the world. Address Dept. CK. **Household Novelty Works, 25 Randolph St., Chicago, Ill.**


OLD FASHIONED ADVERTISMENT ADAPTED TO THE 20th CENTURY
I INSISTED ON THE "20TH CENTURY" LAMP AND I GOT IT. OH JOY! OH JOY!
I WAS PERSUADED TO TAKE ONE OF THOSE "JUST AS GOODS" ON WHICH THE DEALERS MAKE BIG PROFIT. AH ME! AH ME!
20TH CENTURY
BICYCLE & DRIVING
OIL HEADLIGHTS GAS
USE THE 1899 MODELS
CATALOGUE FREE.
20TH CENTURY MFG. CO
17 WARREN ST., NEW YORK

The utmost precision in grinding cups and cones for Automobiles and Bicycles is obtained by using the



New "Rivett" Patent Grinders

For particulars and catalogue address

Faneuil Watch Tool Co., Brighton, Boston, Mass.

Makers of the Celebrated "Rivett" Precision Lathes.

No Money in Advance!

$15.50 HIGH GRADE BICYCLES

Shipped anywhere C. O. D., with privilege to examine. Latest styles for Men Women, Boys and Girls, well made and durable.
$60 "Oakwood" $24.50
$50 "Arlington" $22.00
No better wheels made.
Others at **$10, $13.50, $15.50, $17.50 & $19.50;** all splendid value. Buy direct from manufacturers, thus saving dealers' large profits. Write today for special offer. Illustrated Catalogue Free. **CASH BUYERS' UNION, 162 W. Van Buren St., B-131, Chicago, Ills.**

BAXTER CAMPING OUTFITS

are used by the United States Geological Survey.

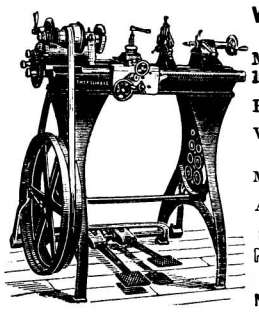
☞ *Send stamp to Frankfort, Ky., for descriptive matter.*

To W. E. BAXTER, FRANKFORT, KY., U. S. A. 12 WELLINGTON SQUARE, CHELSEA, LONDON, ENGLAND.

Through Messrs. Harrods Store I received the "Camping Outfit" with which I am *more* than pleased, and consider it—after a wandering career in the U. S., Africa, etc., as the *ne plus ultra* of a cooking equipment and mess gear combined—a fact which no other fulfills, and I have tried a great many to my discomfort.

Yours faithfully, CLAUD HAMILTON.

The "Reliable" Screw Cutting Lathe



With Automatic Cross Feed

Made in two sizes.
10 x 25 and 10 x 36 inch between centers.
For power or foot power

We make a specialty of all supplies for bicycle manufacturers.
Machinery, Tools, Fittings, etc.
Agents Shelby Steel Tube Co.

Send for '99 Catalogue.

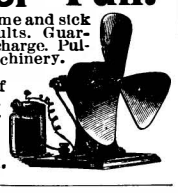
PETER A. FRASSE & CO.
92 Fulton Street,
New York, U. S. A.

Little Hustler Fan.

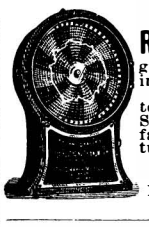
Five inch. Keep Cool at desk, home and sick room. High speed, wonderful results. Guaranteed to run eight hours on one charge. Pulley for running toys and light machinery.

Complete with battery, $2.

☞ Send stamp for circular of larger outfits. Motors from $1 up. *Agents wanted.* Samples list. Discount only by the dozen.



Knapp Electric & Novelty Co.
131 White Street, New York.



DRAPER'S
Recording Thermometer

gives a correct and continuous record in ink on a weekly chart.

It is of especial value in Observatories, Dwellings, Hospitals, Clubs, Schools, Greenhouses, and in manufacturing industries where temperature is an important factor.

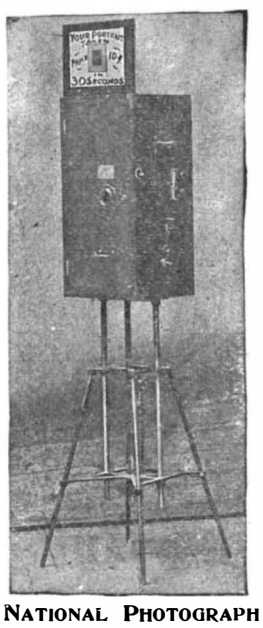
THE DRAPER MFG. CO.,
Weather Instruments,
152 Front Street, New York.

The Most Reliable General Telephone Apparatus Manufacturers in the World.

SWITCHBOARDS the BEST on the Market
TELEPHONES UNEQUALED for Accurate Service.
Complete Perfect CENTRAL ENERGY SYSTEM.
Send for Catalogue. Write for Information.

VICTOR TELEPHONE MFG. CO.,
166 SOUTH CLINTON ST., CHICAGO.

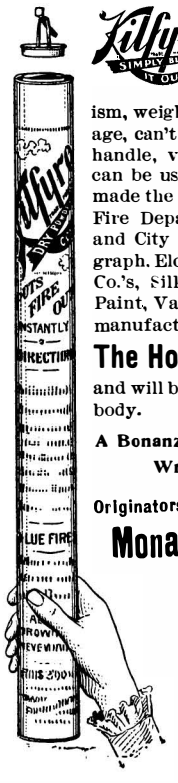
Portable Photograph Machine



. . Persons with Small Capital can make Money.
. . Others have. Why not You?
PRICE ONLY $75.00
. . Or will Lease with Privilege of Purchasing.

WRITE FOR FULL PARTICULARS.

NATIONAL PHOTOGRAPH MACHINE CO.,
85 & 87 BEAVER ST., NEW YORK.



Kilfyre is a dry Powder (fluffy) Compound, put up in metal tubes, 22 inches long and 2½ inches in diameter, has no mechanism, weighs but 3 pounds, does no damage, can't get out of order, is simple to handle, very effective, always ready, can be used by any one, and has been made the standard fire extinguisher by Fire Departments, Government, State and City Institutions, Telephone, Telegraph, Electric Light and Street Railway Co.'s, Silk, Woolen and Cotton Mills, Paint, Varnish, Rubber and Oil Plants, manufacturers of every description. Is

The Home Fire Extinguisher,

and will be used everywhere by everybody.

A Bonanza for Live Agents.

Write for Descriptive Circulars.

Originators and Sole Owners **Kilfyre**

Monarch Fire Appliance Co.
(INCORPORATED),
27 William Street, New York.

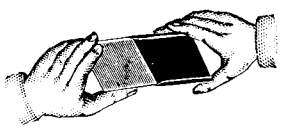
WARNING.

Avoid Imitations and Infringements.

© 1899 SCIENTIFIC AMERICAN, INC.

MAGAZINE CYCLONE CAMERAS

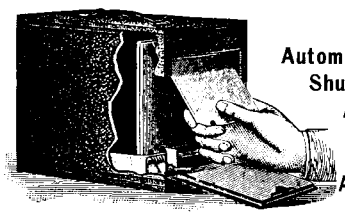
No. 4–3¼x4¼–**$8** **No. 5**–4x5–**$10**



LOADING PLATE CARRIER

Detachable Bulb Release

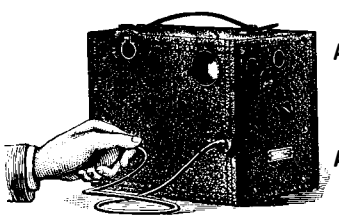
Lens of Exceptional Depth and Rapidity



LOADING CAMERA

Automatic Shutter Always Set

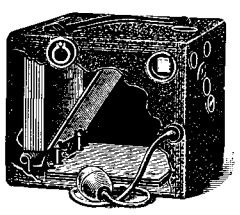
Automatic Plate Changer



TAKING THE PICTURE

Automatic Plate Register

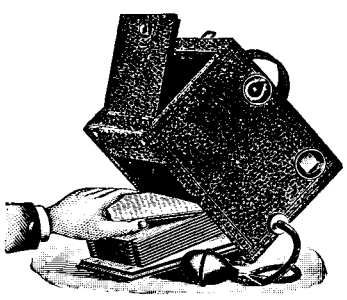
Aluminum Plate Holders



CHANGING EXPOSED PLATES

Three Diaphragms

Simplest and Best Camera on the Market



REMOVING EXPOSED PLATES

"12 Pictures in 12 Seconds"

All Live Dealers Sell Them

WESTERN CAMERA MFG. CO.
131-137 Wabash Avenue
CHICAGO
Write for 1899 Catalogue 79 Nassau St., New York

A WORLD'S RECORD BREAKER.

Three Models: $30, $40, $50

Awarded the SILVER MEDAL by the Omaha Exposition.

Chosen by FOUR out of SEVEN WINNERS at the 1899 Chicago Cycle Show.

PRONOUNCED BY THE LARGEST MANUFACTURER OF BICYCLES IN THE WORLD,
"The Finest Wheel at the New York Cycle Show"

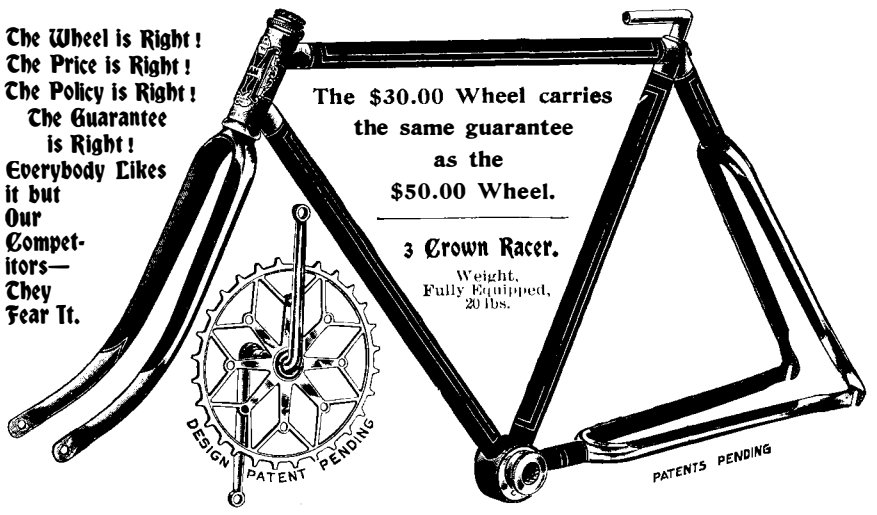
THE Manson

THE ORIGINAL 3 CROWN WHEEL

From a beginning of six hundred wheels per year the Manson has grown to two hundred wheels per day; or a complete bicycle every three minutes every day.

ALL OF THE PARTS MADE IN OUR OWN FACTORY.—Without traveling salesmen, and with *less than ten cents a wheel*, spent in advertising, this, a *Chicago made wheel*, is being sold and ridden in nearly every civilized country on the globe.

The Wheel is Right!
The Price is Right!
The Policy is Right!
The Guarantee is Right!
Everybody Likes it but Our Competitors—They Fear It.



The $30.00 Wheel carries the same guarantee as the $50.00 Wheel.

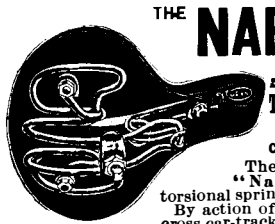
3 Crown Racer.
Weight, Fully Equipped, 20 lbs.

Manson Cycle Co.,

FACTORY, 153-155 W. Jackson Street, CHICAGO.

LARGE CITIES WHERE THE "MANSON" IS SOLD:
NEW YORK, PITTSBURG, CLEVELAND, BALTIMORE, PHILADELPHIA, BUFFALO, SAN FRANCISCO, OMAHA, DENVER.

THE NABER SADDLE



Examine the Spring

There is Nothing Like It.

It has revolutionized cycling.

The secret is in the "**Naber**" double elastic torsional spring.

By action of this spring rider can cross car-tracks in the **Naber Saddle** and not receive a jar. It takes up all jolts, jars and vibration on rough roads, prevents sudden horizontal thrusts when front wheel strikes obstacles. It yields to motions of rider, preventing saddle soreness, chafing, and numbness. It reduces labor of propelling the wheel one-third. Learn of its merits, and you will have no other.

PATENT PENDING.

GENTS', $3.00; LADIES', $3.50, DELIVERED.

What the Rider Thinks of It.

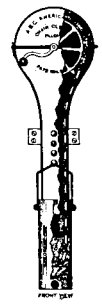
MANSON CYCLE CO., 153-155 W. Jackson St., Chicago, April 29, 1899.

M. H. NABER & CO., 56 Fifth Ave., Chicago.

Gentlemen:—Replying to yours of recent date will say that we find that every "Manson" rider is more than pleased with your "Naber" saddle.

Our "Manson Three Crown" bicycles are equipped with them, and we say to our customers in supplying your saddle—where others are specified—for them to try it, and in case they do not find it the easiest riding saddle they ever had, to return it at our expense and we will furnish any other saddle that they may desire; and of all the saddles we have furnished as yet, we have not had a single saddle returned, and have many letters thanking us for substituting your saddle in place of one specified. Your saddle has merit, and once introduced we believe it will become the most popular saddle on the market. **Your Dealer Has It.**—If not, write

M. H. NABER & CO., 56 Fifth Ave., CHICAGO.



"THE ENDLESS CHAIN"

of a bicycle often needs cleaning quickly and thoroughly. For this purpose you should use

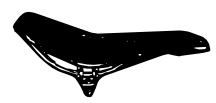
THE A-B-C CHAIN CLEANER.

It will clean any bicycle chain and save it from wearing out quickly. It makes any bicycle chain run easily. It saves time at home or when on the road. It fills and oils the chain. It saves a lot of trouble in cleaning and strength in wheeling. By its use the chain will not get out of order. It keeps the rider in good humor.

PRICE, $3.50.

AMERICAN BICYCLE CHAIN CLEANER CO., 106-108 Beekman St., New York.

"NEWARK SPECIAL"



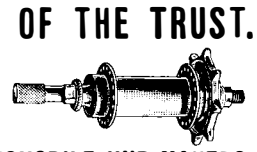
THE PADDED SADDLE FOR 1899.

NO SEWED EDGES.

NEWARK CYCLE SPECIALTY CO.,
26-28 Prospect Street, Newark, N. J.

FORCED OUT OF THE TRUST.

Howard Mfg. Co.,
Mt. Holly, N. J.



BICYCLE AND AUTOMOBILE HUB MAKERS.

Any kind of ball-bearing vehicle hubs to order. Write for particulars.

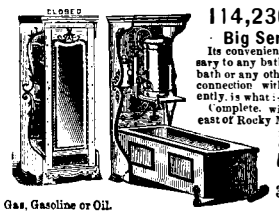
"CALCIUM CARBIDE."

Double screened and selected, in 1, 2, 5, 50 and 100 lbs. air-tight cans, ⅛, ¼ and one-fourteenth inch size. No Dust.

ABSOLUTELY PURE CRYSTALS.

NOTICE.—Orders for **One Pound Cans** promptly filled.

The Acetylene Gas Illuminating Co.,
107 WALKER STREET, NEW YORK.



Gas, Gasoline or Oil.

114,230 NOW IN USE.
Big Service. Little Cost.

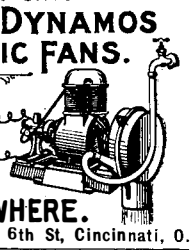
Its convenient Hot Water Supply, so necessary to any bath; and that it may be used in a bath or any other room to equal advantage, in connection with water service, or independently, is what is making the "Mosely" famous. Complete, with heater, $26.50 up, delivered east of Rocky Mountains. Monthly payments, if wanted. Send for Catalogue of Tubs and Heaters.

MOSELY FOLDING BATH TUB CO.,
358 "K" Dearborn St., CHICAGO.

KEEP COOL

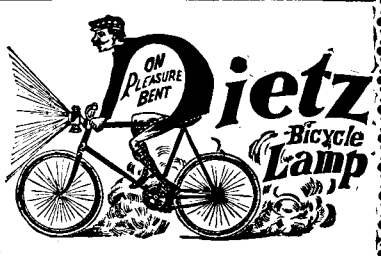
SEND FOR CIRCULAR "C"

WATER DYNAMOS AND ELECTRIC FANS.



STRONG BREEZE FROM HOUSEHOLD FAUCET.
CAN BE USED ANYWHERE.
The Carlisle & Finch Co., 820 6th St, Cincinnati, O.

THE DIETZ Bicycle Lamp

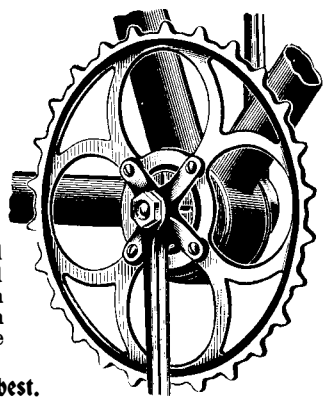


gives a strong, unflinching white light through ten black hours. Heavy blows overhead or under tire will not extinguish it. Price by mail to any address, $2.50. Our circular of this lamp will certainly interest you. Shall we mail it?

R. E. DIETZ COMPANY
77 Laight Street,
Established 1840. NEW YORK CITY.

EVERY BICYCLE RIDER

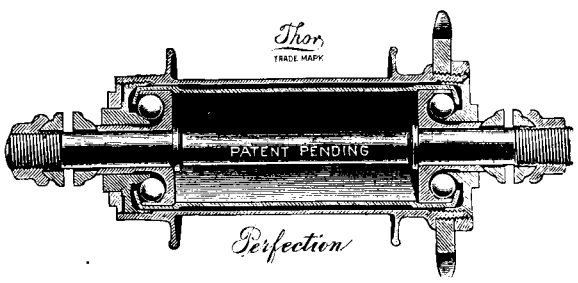
Thor TRADE MARK



who has ridden a wheel equipped with the celebrated **THOR CRANK HANGER** and **THOR HUBS** will attest to their superb action and freedom from friction. Both are mechanical perfection, far in advance of other devices, and serve to make bicycle propulsion easy and pleasurable.

Your Dealer and Manufacturer will tell you they are the best.

THE THOR CRANK HANGER consists of a patented two-piece crank possessing the advantages of perfect simplicity, rigidity and security, removable at will without disturbing bearing parts or adjustment; and the **THOR** hanger bracket with eccentric for adjusting the chain, dispensing with the old style rear chain adjustment, the whole making the neatest, simplest and most perfect mechanism of a crank hanger ever produced to delight bicycle enthusiasts.



Numberless riders have said:

"I have ridden many wheels, but after using one with THOR fittings I decided it was my first real ride."

When you get your 1899 mount insist on **THOR** fittings—the most perfect made. See that the trade mark "**THOR**" is on the cranks, hubs, and seat post and handle bar expanders.

The ball-bearing portion of your wheel is the most essential. **THOR Cranks, Crank Hangers, Hubs and Fittings** add but little to the additional cost and are well worth the difference.

WRITE FOR CATALOGUE.

AURORA AUTOMATIC MACHINERY CO.,
AURORA, ILL.

Thor TRADE MARK

FIRST AND LAST

Solar Cycle Lamps

Are an Unqualified Success
Not an Experiment **$3.50**

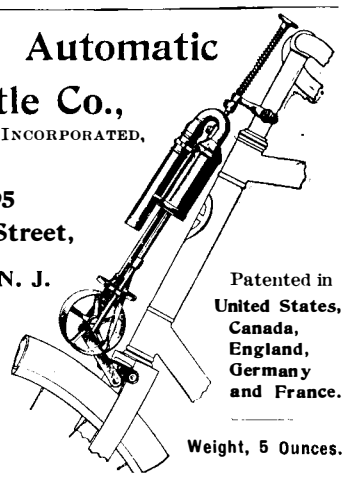
SIMPLEST and SAFEST.
Burn Brightest and Longest

BADGER BRASS M'F'G CO., KENOSHA, WIS.

Hall's Automatic Whistle Co.,

INCORPORATED,

193 & 195
Halsey Street,
Newark, N. J.



Patented in United States, Canada, England, Germany and France.

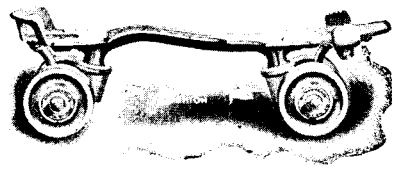
For Bicycles, Launches, Electric Wagons, Etc.

Weight, 5 Ounces.

RICHARDSON

Ball Bearing Roller Skates

FITTED WITH ALUMINUM ROLLERS.



The Most Elegant Roller Skate Ever Produced.

Send for Catalogue containing testimonials from the World's Greatest Skaters.

We also make the **REX SKATE** for rink and sidewalk use.

RICHARDSON BALL BEARING SKATE CO.,
1384 N. Clark Street, Chicago.

© 1899 SCIENTIFIC AMERICAN, INC.

prises an inner rim supported by a hub, and band-springs interposed between the two rims. The springs are secured to one another and to one rim, and have their ends adjustably secured together and to the other rim. The inventor claims that a wheel thus constructed possesses all the buoyancy of a pneumatic-tired wheel, and that it has the advantage of being much stronger and of being more easily repaired.

PROCESS OF TANNING.—GEORGE W. HOUSTON, Marietta, Fla. Instead of using red-oak bark or any of the other tanning agents, the inventor of this new process employs an ooze made from a shrub commonly known as "horse-wickey" or "stagger-bush." This ooze, it is stated, will not only tan leather more quickly than other materials in common use, but is also much more plentiful and economic, and produces a fine grade of leather at less expense. According to the strength of the ooze and the character of the hides, the tanned leather can be given various shades.

WINDING-FRAME.—CORRY JONES, Long Island City, N. Y. This invention provides improvements in silk-winding frames in which quills are held by cones and in which the spindles are removably connected with the driving mechanism. The improvements in question provide means whereby the quill and the filling disconnect automatically the spindle from the rotating well to permit a convenient removal of the quill and spindle from the machine without danger of entangling the silk. The improvements also permit the substitution of an empty quill for the quill-spindle, and the automatic connection of the spindle with the driving mechanism.

PROCESS OF MANUFACTURING MINERAL WOOL.—ALEXANDER D. ELBERS, Hoboken, N. J. It is the purpose of the present process to provide a means for making mineral wool which is more free from sulfur and therefore of a better quality than can be produced by the methods at present in use. The process consists in remelting hardened blast-furnace slag in a cupola-furnace in admixture with the sulfates of alkaline earths and blowing it into mineral wool.

BLACKING-BRUSH.—JOSEPH R. DE WITT, San Antonio, Tex. Upon the back of a blacking-brush a wheel is mounted connected by arms with a dauber and with a box of blacking, the wheel being operated by a rod. In its normal position the box is held in place by a catch. When it is desired to replenish the dauber's supply of blacking, the rod is pushed forward, thus causing the wheel to carry the box over the bristles of the dauber. When a sufficient amount of blacking has been gathered by the dauber, the rod is pulled back, thus causing the box to be returned to its normal position.

LINE-PEN.—LYMAN H. ZEIGLER, Millbank, S. D. The pen provided by this inventor is designed to facilitate rapid adjustment, thus enabling lines of varying width to be conveniently and effectively drawn. The pen has two pivotally connected arms pressed apart by a spring. Two fingers are attached to the arms and coact with each other to form the pen, the spring serving to keep the fingers together. A thin plate is held between the fingers and has its free portion twisted to spread the ink.

ORE-LEACHING APPARATUS.—ALBERT F. DUEY, Salida, Colo. The apparatus includes a leaching-tank, in the bottom of which is a perforated pipe connected with a compressed air supply. The tank containing the leaching liquid is connected with the air-supply pipe, whereby the air and liquid are injected together. The stirring of the ore by the bubbles of air serves to increase the efficiency of the solvent liquid, so that the mineral is more quickly dissolved than would otherwise be possible. The apparatus can be used in chlorination and in the cyanid or other chemical processes of treating ores, performing its work, it is claimed, from one to thirty-six hours more quickly than has hitherto been the case.

ORGAN-ACTION.—JOSEPH SLAWIK, Bloomfield, N. J. The invention provides an organ-action whereby the playing either of the upper or lower key-board causes a sounding of its sounding devices, and by the use of the desired couplings the playing of one of the keyboards causes a sounding of both sets of sounding devices simultaneously to produce a grand-organ effect. A pneumatic coupler-action is provided comprising an exhaust-valve over an outlet in the passage between the upper keyboard-valve and its action. On the valve-stem are a series of diaphragms over which air-chambers are located. By means of coupler draw-stops the air is exhausted from the chambers. By means of connections with the diaphragms from the valves of the lower key-board the exhaust-valve is actuated on playing the keys of the lower keyboard.

HEEL-RUBBER.—JOHN H. MORROW, Chicago, Ill. The heel-rubber is designed to prevent the slipping of the foot on frozen or wet sidewalks, and is provided with a bottom which is made in the shape of the bottom for the heel of a shoe or boot, and which has a flange fitting the sides and back of the heel. The heel-rubber is furthermore provided with a jointed front flange which can be secured on the front portion of the heel.

WRENCH.—JAMES L. MARTIN, Marion Center, Penn. This nut-wrench has its jaws in the form of two spring-prongs adjusted toward and from each other by a screw, and adapted especially for application to a bit-brace. In wrenches of this class the spring-tongs frequently twist, and by being forced too closely together, are prematurely broken. In order to overcome this objection, the inventor provides the jaws with lugs, to one of which the adjusting-screw is rigidly secured. By means of this construction the true movement of the prongs toward and from each other is assured, and their springing out of alinement prevented.

SMOKER'S TRAY.—PERCY S. COOK, Manhattan, New York city. This invention provides a tray so constructed that ashes deposited at the margin will be directed to a well extending from end to end and from side to side of the tray. The invention also provides a match-receptacle adapted to receive loose matches or a pedestal capable of holding boxes of matches of different sizes in an upright position.

SMELTING-FURNACE.—CHARLES BISHOP, Knoxville, Cal. This furnace provides for a concentration of the heat above the arch upon which the ore is to be placed for smelting. In the central chamber a settling-pot provided with bullion and slag off-takes is located. An apertured ore-supporting arch is mounted above the settling-pot; and into this arch the fire-boxes open. Apertured flues in opposing sides of the central chamber lead through the sides of the arch; and apertured flues in the other two opposing sides of the chamber lead through the top of the arch at the ends. The slag and bullion are automatically distributed; and the vapors from the ore will be condensed in the off-take flue, means being provided to receive the metal thus condensed.

GASOLINE-LAMP.—JAMES A. YARTON, Omaha, Neb. This lamp is designed to be used in order to heat a mantle to incandescence. The lamp comprises a chamber having a gas-supply pipe entering one side, and an upwardly-curved deflecting plate in front of the opening of the pipe. A gasoline-tube extends vertically through the chamber and has perforations in its sides within the chamber. A ring supported at the upper end of the tube serves the purpose of distributing the gasoline evenly. A series of wires are suspended from the ring and within the tube, and conduct the heat down to insure the perfect volatilization of the gasoline.

INTRENCHING-TOOL.—LUTHER H. WIGHTMAN, Boston, Mass. Various tools have been designed for digging trenches, but they have been either too heavy to be conveniently carried or too small to handle sufficiently large quantities of earth. The tool provided by this invention, in order to overcome these objections, is provided with a pointed and curved body having a tang at one end. The edge of one of the sides of the body is sharpened. A hollow handle is riveted to the tang and also has a portion riveted upon the body. This tool has a weight of about one and five-eighths pounds, and has a dirt-holding or lifting surface of about thirty-four square inches.

ARTIFICIAL TOOTH CROWN AND BACKING.—CEPHAS WHITNEY, Kingston, Jamaica. The present invention provides a backing and crown for artificial teeth so constructed that the facing or porcelain, if fractured, may be readily removed and another substituted. A crown or cap is also provided which serves materially to hold the porcelain in proper position and to prevent the porcelain from chipping at its cutting edge. The backing enables a tooth to be applied to crown or bridge work in the customary manner, if it be so desired.

MICROMETER DEPTH-GAGE.—CLAUDE L. WATERS, Stamford, Conn. This micrometer gage is arranged to permit direct reading of the depth of a hole without further mental calculation and without covering up the graduations. The gage has a base capable of bearing firmly upon the object to be measured. On the base are fixed a threaded micrometer-spindle and a barrel inclosing the spindle. An indicator-sleeve screws on the spindle and slides between the barrel and the spindle.

HAT-FASTENER.—SHELDON A. STIENBARGER, Augusta, Ill. In the hat-fastener there are combined a frame on which are collars lengthwise movable, combs pivotally attached to the collars, a spring serving to draw the collars toward each other, and tapes attached to the combs, serving to move the collars outwardly and to throw the combs downwardly. When the hat is placed upon the head the combs enter the hair, and assume a horizontal position by the action of the spring, thus causing the hat to be effectually secured. By drawing the tapes outwardly the hat may be lifted from the head, the combs sliding out without injuring the hair.

ROPE-CLAMP.—LEWIS W. SAMMIS, Greenpoint, Brooklyn, New York city. The rope-clamp comprises two parts—a body and a dog. The body has two separated arms provided at their outer ends with pivot-lugs extending toward each other. The dog fits between the arms of the body and has recesses receiving the pivot-lugs. One arm of the dog and the corresponding end of the body are adapted to clamp a rope between them; while the other end of the dog acts as a lever to hold the parts together, the lugs being held in engagement with the dog.

CONSTRUCTION OF METAL-CONCRETE-ARCH BRIDGES.—HOWARD V. HINCKLEY, Topeka, Kans. A novel construction in metal-concrete-arch bridges has been devised by this inventor, whereby the difficulties hitherto encountered are overcome. With the series of parallel metal I-beams extending longitudinally through the arch are connected a series of bars or clamps having integral, hooked ends clasping the longitudinal flanges of the beams. These clamps are also embedded in the concrete so that they tie the I-beams together against lateral movement. Concrete spandrel-walls are erected on the arch. Metal anchorage-frames held rigidly to the beams extend up into the spandrel-walls and support them. In order to prevent the cracking of the spandrels an expansion-joint is employed.

DISPLAY-STAND.—CLARK R. REID, Piqua, Ohio. This invention seeks to provide a means for supporting advertisements so that they can be moved around a circle. In connection with the advertisements, a concave or convex mirror is employed which is rotated with the advertisements, so that the image of the face reflected will be distorted. The mirror serves the purpose of attracting attention to the advertisements.

COMPUTING-SCALE.—WILLIAM R. DUNN, Alton, Ind. The scale has a platform actuating beams, and has, furthermore, two weights working on the beams and referring to weight and price, so that upon the proper adjustment of those weights according to the price and the desired amount of the article, the balancing of the scale will indicate that the proper amount of the commodity is on the scale.

Designs.

BEARING-PLATE FOR VEHICLES.—GEORGE W. MCCONNELL, Carrollton, Ohio. The plate has an opening provided with a horizontal lug at the top and a horizontal lug at the bottom. The opposite side of the plate has a vertical lug at each side of the opening in the plate.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS ETC.

HINTS ON AMALGAMATION AND THE GENERAL CARE OF GOLD MILLS. By W. J. Adams. Chicago: Modern Machinery Publishing Company. 1899. Illustrated. Pp. 111. Price $2.

Practical men in all parts of the world are rapidly improving mining processes, and it is necessary for those who are engaged in any mining or metallurgical pursuit to keep up with the times. It is for this reason that we welcome any book written by a practical mining engineer, like the present volume. It is a reference book of actual gold milling practice as determined by an experience of twenty years and it is written in language which can be understood by all.

SMALL ACCUMULATORS. HOW MADE AND USED. Edited by Percival Marshall. New York: Spon & Chamberlain. London: E. & F. N. Spon, Limited. 1899. Fully illustrated. Pp. 80. Price 50 cents.

The author treats briefly of the theory of the accumulator, and then describes how to make a four-volt pocket accumulator and a twelve-volt accumulator, and finally describes various types of storage batteries and gives directions for charging and using them. It appears to be a very useful little book.

SANITARY ENGINEERING OF BUILDINGS. By William Paul Gerhard. Vol. I. With 103 illustrations and 6 plates. New York: William T. Comstock. 1899. Pp. 454. Price $5.

The author is a well known sanitary engineer, and we do not know of any one who is better qualified to deal with the subject, which is of vital importance. Another volume is in active preparation, but each volume is complete in itself. Nearly every phase of modern sanitary plumbing is treated. The book is printed in large type and is well illustrated.

STEVENS' MECHANICAL CATECHISM FOR STATIONARY AND MARINE ENGINEERS, FIREMEN, ELECTRICIANS, ETC. By H. G. Stevens, M.E.E. Chicago: Laird & Lee. 1899. 18mo. Pp. 335. Price $1 and $1.50.

All of the subjects are treated in the most interesting and thorough manner and it is written in plain language. The popular question and answer system is used and there are over 240 sectional cuts and illustrations. There is a great deal of literature already on the subjects treated in this volume, but there is no question that the present work will prove useful to practical engineers and machinists and those who aspire to master these trades. One thing which we like particularly is the clear way in which many of the diagrams are lettered. The book is handsomely printed and bound.

THE ARITHMETIC OF CHEMISTRY. A Simple Treatment of the Subject of Chemical Calculations. By John Waddell. New York: The Macmillan Company. London: Macmillan & Company, Limited. 1899. Pp. 133. Price 90 cents.

Chemical arithmetic is now being taught in many colleges with the aid of a special text book, and though there are already several chemical arithmetics on the market, the present volume will certainly prove valuable. Many of the questions have been actually used in examination papers at British and American universities. The subject possesses no real difficulties when properly explained, and the volume before us will accomplish that work.

SHOE AND LEATHER REPORTER ANNUAL. New York: Shoe and Leather Reporter. 1899. Pp. 693. 8vo.

The Shoe and Leather Reporter Annual is of great value to the shoe trade, as it contains a list of all the shoe manufacturers and dealers in the United States and Canada, as well as leather dealers and manufacturers in all countries. It is evidently a great task to compile a book of this nature, and it is to be hoped that the trade will appreciate the efforts of the publishers.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION. Showing the Operations, Expenditures, and Condition of the Institution to July, 1897. Washington. 1898. Pp. 686.

The Annual Report of the Smithsonian Institution is really much more than a report, for the report proper only occupies some 80 pages of the 686. The rest is taken up by what is called "General Appendix," which furnishes brief accounts of the scientific discoveries in particular directions, including reports on the investigations made by collaborators of the Institution and memoirs of a general character or on special topics that are of interest and value to the numerous correspondents of the Institution. The articles are admirably selected and are splendidly illustrated, the whole really forming a remarkable collection of brief monographs.

THE SPIRIT OF ORGANIC CHEMISTRY. An Introduction to the Current Literature of the Subject. By Arthur Lachman, B.S., Ph.D. With an Introduction by Paul C. Freer, M.D., Ph.D. New York: The Macmillan Company. 1899. 12mo. Pp. 229. Price $1.50.

This book is intended primarily as a supplement to text books of organic chemistry. A beginner coming upon the 10,000 pages which mark the annual growth of the literature of organic chemistry cannot but be bewildered, and it is to answer the questions which naturally arise in the minds of the students that the present book has been compiled. The articles which make up this volume will be regarded as an important contribution to the history of science. It is to be regretted that organic chemistry is regarded as a labyrinthian specialty, but Prof. Lachman's book will tend to clear up many difficulties and is a contribution to the history of science as well.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Gasoline Brazing Forge, Turner Brass Works. Chicago.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 141 Varick St., N. Y.

Order White Metal & Brass Pattern Letters & Figures of H. W. Knight & Son, Seneca Falls, N. Y. Drawer 1115.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

4½-inch Equatorial Telescopes, with tripod stand, finder, 3 eyepieces powers: 50 to 350. Powerful, compact, handy. Price only $50. Tydeman & Son, Opticians, Camden, N. J.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7658) F. L. asks: 1. Can a water power be utilized economically or not for producing heat capable of steaming up a boiler, heating driers on a paper machine, or giving heat for any industrial purpose? A. We know of no mode in which a water power can be used in any direct manner for producing heat. 2. I know of paper mills which have a surplus water power which could be utilized for producing heat for their driers, thus doing away with fuel. I know that a dynamo can produce heat, but I am informed that the objections in using it for steaming a boiler are too many to be practical. I am also informed that using a current inside the driers is not practical, as the dampness of the paper will neutralize the efficiency of the current. Is that correct? A. We do not know of any instance in which electricity has been used to heat the driers of a paper machine; but we can see no reason why it cannot be used, except its cost. If it can be produced at a low figure, it can be used for any heating purpose whatsoever. 3. A dynamo can be used for producing carbide, which can be transformed into acetylene gas, with which a boiler can be made to steam. Is this practical where the water power is abundant? Will the economy in fuel derived by using said carbide warrant the cost of the installation of a carbide plant, even considering that the surplus carbide could be sold to the trade? Or will it pay better to sell the whole production of carbide to the trade, and buy coal for the boilers? You must not lose sight of the fact that I am talking of paper mills having a surplus waterpower, and using at present coal for heating, worth about 40 francs per ton, and using all the way from one to five tons daily. A. Water power is used for the production of most of the carbide which is made. We should think that it would be better to sell the carbide and buy coal than to use acetylene gas as fuel for heating purposes. 4. Can heat be produced with compressed air, viz., by reheating the outlet pipe of a reservoir? A. Compressed air is not an economical source of heat. 5. Do you know any other way for producing heat by means of a water power? A. No.

(7659) H. S. asks: What size of wire, B. & S., would be necessary for primaries for 500 four-watt 16 candle power lamps, 4 miles from center of distribution, 2,200 volts on line and 10 per cent loss? A. A single phase alternate current circuit would require No. 4 wire, B. & S. gage. A three phase circuit would require No. 7 wire, B. & S. gage.

(7660) M. F. K. writes: While reading your "Notes and Queries" in the SCIENTIFIC AMERICAN I noticed that you answer fully all questions on electricity. Have you any one book from which you get this information, or any set of books? If so please name them in your reply to this letter, and also prices of same. A. There is no one book from which we obtain our answers to queries. If there were, we would not tell what it is. Of course not. Our business would be gone. Nor is there any set of books. Practical questions can only be answered from practical experience, and knowledge and books cannot give that. We have served a long apprenticeship to get it.

(7661) R. W. S. says: Please give recipe for solution which, when applied to glass, dries giving a ground glass effect. Solution does not injure the glass. A. Try the following:

Sandarac	90 grains.
Mastic	20 "
Ether	2 ounces.
Benzole	½ to 1½ "

The proportion of the benzole added determines the nature of the matt obtained.

© 1899 SCIENTIFIC AMERICAN, INC.

M. & W. LANCASTER GAS LAMP.

Burns Loose Carbide.

Easily Cleaned. Keeps Cool. Lights Instantly.

FLAME ALWAYS STEADY.

No Flickering.
No Blowing.

SECTIONAL CUT OF TRAP.

The Combination Water Trap and Gas Seal is the secret.

When pressure is too great it automatically cuts off the water supply and affords a vent for the surplus gas.

When more pressure is needed it allows just the required quantity of water to pass.

Pressure at burner is always uniform.

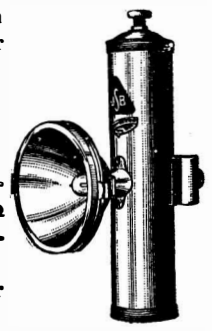
PRICE, $3.00; EXPRESS PAID.

The Matthews & Willard Mfg. Co.,
MANUFACTURERS,
40 Murray St., New York. Waterbury, Conn.

Lamp Perfection

means everything in comfort to the rider

U. S. B. Electric Bicycle



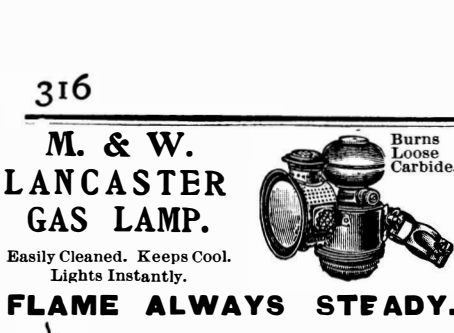
Lamp has every detail perfected, even to recharging batteries.

Light cheaper than oil or gas.

Send for Catalogue A.

United States Battery Co.
253 Broadway, New York.

Columbia ❖ ❖ ❖ Automobiles



Electric Runabouts, Electric Phaetons,
Electric Dos-a-dos, Electric Surreys,
Electric Broughams, Electric Cabs,
Electric Carriages for Physicians,
Electric Delivery Wagons,
Electric Emergency and Repair Wagons.

COLUMBIA AUTOMOBILE CO.
HARTFORD, CONN.
NEW YORK OFFICE, 60th Street and Broadway.

Manufacturers of

MOTOR CARRIAGES

Gasoline Fuel. Strictly High Grade. Several Styles. Carriages on exhibition.

Book Orders Promptly.

AUTOMOBILE COMPANY OF AMERICA,
Hudson Building, New York.

Dealers in Wheels

and those who rent them to possible buyers, should be particular to have them in good condition, with an easy and smooth running chain that insures comfort and satisfaction to the rider, and a minimum wear and expense to the dealer.

DIXON'S CYCLE CHAIN GRAPHITE

is the best possible lubricant for bicycle chains. It is easily applied and is conveniently packed. For home use or repair shops equally convenient.

☞ *Send for Circulars and prices.*

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

As Good as an Orient?

If we are not represented in your Territory, write for Catalog and Prices.

There are many good Bicycles besides the

. . ORIENT . .

but "As Good as an ORIENT"—that's another story.

There are many good battleships, but none quite as good as the Oregon. Last year's war proved it. There's no Bicycle quite as good as the **ORIENT.** Last year's records proved it. At 275 races the "Just as goods" lined up with **ORIENTS** at the start, but not at the finish.

It was the **1.30 ORIENT** that placed the world's hour record at 34 miles 1223 yards.

It was the **1.30 ORIENT** that mounted Elkes, Taylor, Linton, Michael, McDuffee, Taylore, Titus and Waller.

WALTHAM MFG. CO.,
WALTHAM, MASS.
400 CRESCENT PARK.

FISK TIRES

❖ ❖ TRADE MARK ❖ ❖

❖ ❖ FOR ❖ ❖

Bicycles, Carriages and Automobiles

FULLY GUARANTEED.

Fisk Rubber Co., Chicopee Falls, Mass.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

BALL BEARING AXLES AND RUBber Tires.—A paper read before the Carriage Builders' National Convention, Philadelphia, October, 1894, showing the advantage to be derived from the use of ball bearings and pneumatic tires on road vehicles. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **992.** Price 10 cents. To be had at this office and from all newsdealers.

The American Electric Vehicle Co.

are the **pioneers** in Electric Vehicle construction.

Our **new improved battery,** and **single motor equipment** (patented) make us also the **leaders** in the field.

In speed, ease of control, economy and mileage capacity, we reach the **up-to-date limit** of **perfection.** Send for Catalogue.

AMERICAN ELECTRIC VEHICLE CO.,
56-58 W. Van Buren Street, - - - - - - CHICAGO, U. S. A.

PREMIER MFG. CO.

Pneumatic Tires,
Steel Rims,
Ball Bearings,
Wire Wheels,

Gears, etc., for Horse and Motor Vehicles.

HARTFORD, CONN.

RACYCLES ARE BETTER THAN BICYCLES

New Ideas, New Angles, New Lines.

A Narrow Tread applies the rider's power to the best advantage. In bicycles this construction increases internal strains and friction, but in the Racycle the supports of the strain (the balls) are at the ENDS of the shaft instead of in the middle, which so distributes the strains and reduces the friction that 27 per cent. of the labor is saved. The rider goes farther and faster, and the wheel lasts longer.

The Taper Head permits stronger bracing where the frame strain is greatest, and adds grace to the frame.

Their mechanical superiority makes Racycles an easy seller for live agents.

Catalogue on application.

The Taper Head.

Miami Cycle and Mfg. Co., Middletown, O.

The Christy Adjustable Saddle Price **$3.00**

You naturally feel that you want to get the easiest riding saddle made and one so constructed that saddle injury is impossible . .

Regular Style Men's and Women's Models $2

5,000 PHYSICIANS

have indorsed the Christy Saddle as the only saddle to ride. The new Christy Adjustable Saddle can be adjusted to any size . . .

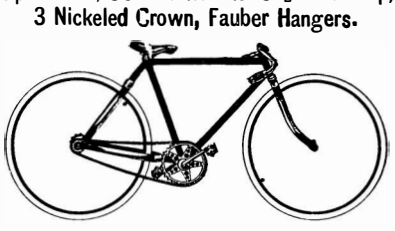
Catalogue of all athletic sports Free.

A. G. SPALDING & BROS.
NEW YORK. CHICAGO. DENVER.

THE LATEST IDEA IN BICYCLE CONSTRUCTION,

THE PARKER BICYCLES

Up-to-date, 30 inch Wheels. 3½ inch Drop, 3 Nickeled Crown, Fauber Hangers.



One of these Bicycles Free to Anyone

Distributing our SOAPS. Cash or hundreds of other valuable premiums if preferred.

Write for large Catalogue and full information. Ask for Catalogue No. 11.

THE MEDICATED CREAM SOAP CO.,
306 Clinton St., Chicago.

Mark Your Tools with a Steel Stamp.

Send for Price List No. 2,

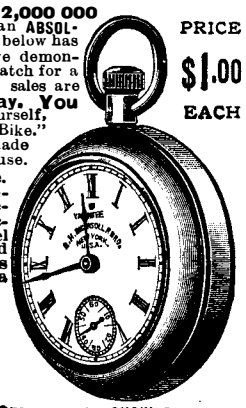
© 1899 SCIENTIFIC AMERICAN, INC.

It can be attached to your bicycle, and will afford you more real pleasure than any improvement since the advent of pneumatic tires! Think of riding 30 miles and having to pedal only 20 miles. Think of riding down the steepest hills with your feet Still on the pedals and your wheel under perfect control! You can make a "Century" on your wheel when fitted with the "Morrow Coaster" and brake "Easier than you can ride 75 miles without it. Thousands of wheels in all parts of the world fitted with the "Morrow." Write us for prices. Eclipse Bicycle Co. Box "K." Elmira N.Y.

THE INGERSOLL DOLLAR WATCH

Now household words. **2,000 000 Sold** in 2 Years under an **ABSOLUTE GUARANTEE** printed below has made them so. We have demonstrated that a **GOOD** Watch for a Dollar is possible. The sales are now over **3,000 per day. You** want one—either for yourself, your Boy or your "Bike." As good as any Watch made for ordinary every-day use. **Keeps Accurate Time. (Guaranteed** as below.) Has lever escapement, quick train; second hand; good nickel case; Keyless Wind and Set; 18 size. Buy **this** Watch to **use** and a

PRICE **$1.00** EACH



GUARANTEE
SOLD BY
R. H. Ingersoll & Bro.
MAKERS
65 CORTLANDT STREET, NEW YORK CITY
AGREE THAT IF WITHOUT ABUSE, THIS WATCH FAILS TO KEEP GOOD TIME, THEY WILL UPON ITS RETURN TO THEM, DIRECT OR THROUGH AGENT NAMED ABOVE, WITHIN ONE YEAR FROM ABOVE DATE, REPAIR OR REPLACE IT WITH A NEW ONE

$50.00 one for SHOW. Sent postpaid for **ONE DOLLAR.** Attachments for Bicycle 25c. extra. ROBT. H. INGERSOLL & BRO., 67 Cortlandt St. Dept. No. 147, N.Y.

The Little Giant Fire Extinguisher

Price $2 each. West of the Mississippi, $2.50 each. (To unseal, twist the handle.)

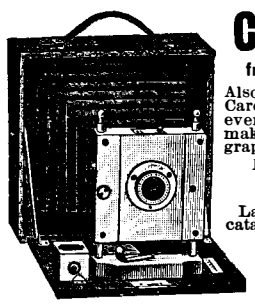
The **Little Giant** gets better results on fire than extinguishers costing from $15 to $25. The only fire extinguisher indorsed and used by the Fire and Marine Insurance Companies, as a whole, in New York City; also used in the New York Fire Department. Every Municipal building belonging to New York City is equipped with this extinguisher; also adopted and used by the United States Navy and United States Army. Light, cheap, simple, durable and efficient.

Have extinguished hundreds of accidental fires in the past two years. Never fails to put out fire. Needs no care or attention. Any child can work it. No acids are used and no gases are generated until the solution comes in contact with fire, thus preventing explosion. This cannot be said of any other fire extinguisher in the world. ☞ **AGENTS WANTED.**

☞ *Books and pamphlets sent FREE on application. Our book of 50 pages describing accidental fires extinguished, you will find most interesting.*

We guarantee every extinguisher, and when used at accidental fires they are replaced with new ones by giving us a testimonial of the fire acknowledged before a notary public.

The Little Giant Fire Extinguisher Co., 20 Liberty St. N.Y.



CAMERAS

from $2.50 to $50.

Also Plates, Papers, Cards, Developers, and everything required to make and finish photographs complete

Instruction books free with all cameras.

Large and complete catalogue free.

Jas. H. Smith & Co., E-311 Wabash Ave., Chicago.

ALL WHEELMEN WEAR

The Pace Maker Foot Clip and Pedal Balancer. Neat, strong, durable. Will adjust to any shoe. Price Foot Clips, 50c. Pedal Balance, 15c. Made only by **RACINE TOE CLIP MFG. CO., Racine, Wis.**

We Make a Special

Camera for Wheelmen.

Combining great compactness and strength with absolute reliability. Plates or film. Prices $8.00 and upward.

Premo Cameras, owing to their simplicity of construction, strength and absolute reliability, are favorites among amateurs of all nations. Lens and Shutter are designed to meet all the requirements of exposures made under the most trying conditions.

☞ *1899 Catalogue sent on application.*

Rochester Optical Co., 50 South St., Rochester, N.Y.

Rambler BICYCLES

$40.

We feel that nothing further need be said about 1899 Ramblers. Agencies everywhere.

GORMULLY & JEFFERY MFG. CO., Chicago, U.S.A.

DETACHABLE

G&J TIRES

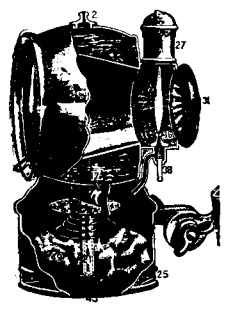
FOR AUTOMOBILES AND BICYCLES.

are
as much better
than other
detachable tires
as
detachable tires
are better than
single tube tires
of any make.

Prices of G. & J. Tires for Automobiles and Bicycles on application.

G. & J. TIRE CATALOG FREE,

GORMULLY & JEFFERY MFG. CO., CHICAGO.



Sectional View—1899 Model

THE CALCIUM KING.

PIONEER of Gas Lamps for Bicycles and Carriages.

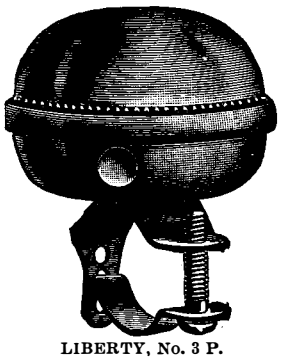
BURNS LOOSE CARBIDE. HANDSOME AND COMPACT.
ALWAYS TRUSTWORTHY.
NO DISAGREEABLE CLEANING, SMOKE OR SMELL.
NO WIND WILL BLOW IT OUT. NO JAR CAN PUT IT OUT.

PRICE, $3.50—Express Paid.

Write for Booklet. **Agents Wanted Everywhere.**

THE CALCIUM KING LAMP CO., WATERBURY, CONN., U. S. A.

The FILIPINOS Must Have LIBERTY BELLS.



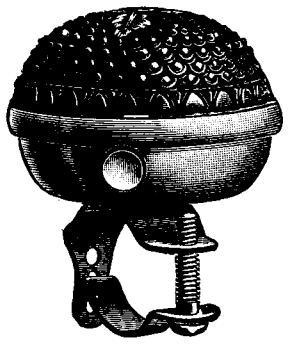
LIBERTY, No. 3 P.

Continuous Ringing.

Adjustable Push-Button.

Gong does not turn when bell rings.

Rings longer and winds quicker than any other.



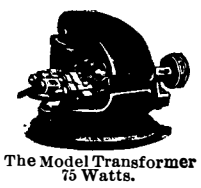
LIBERTY, No. 7 P.

MADE BY

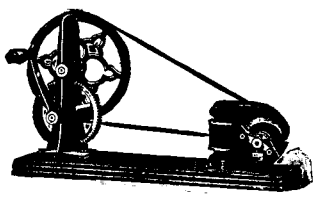
THE LIBERTY BELL CO.

(Formerly The Bristol Bell Co.)

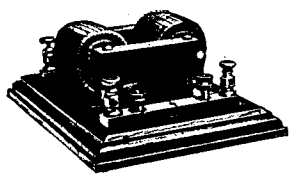
BRISTOL, CONN., U. S. A.



The Model Transformer 75 Watts.

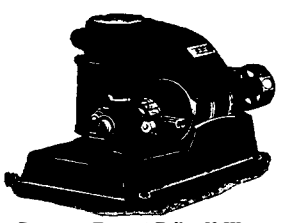


Model Dynamo "1." 75 Watts.



The Midget Dynamo or Motor. 10 Watts.

The Model Arc Lamp. 200 C. P.



Dynamo Type "B." 450 Watts

Experimental Apparatus for Students of Electricity.

The Elbridge Electrical Mfg. Co.,

Elbridge, N. Y., U. S. A.

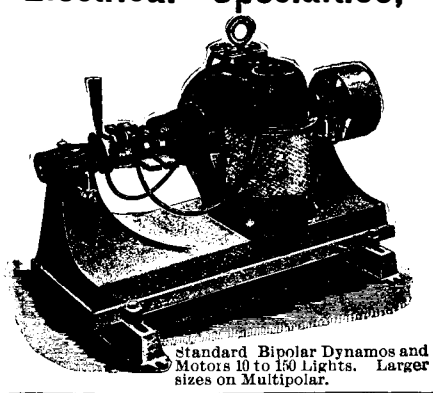
Special Apparatus Designed and Built to Order.

Send 2-cent Stamp for Illustrated Catalogue.

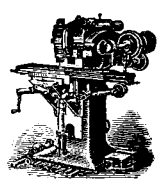
Sparking Dynamo for Gas Engine Ignition.

Manufacturers and Contractors of

Electrical Specialties,



Standard Bipolar Dynamos and Motors 10 to 150 Lights. Larger sizes on Multipolar.



OUR LATEST IMPROVED No. 2 VAN NORMAN DUPLEX.

Dimensions: Longitudinal feed of table, 28 in.; cross feed, 10 in.; vertical feed of knee, 18 in.; ram, carrying cutter head, can be moved in and out over table, 15 in.; weight, 2,200 lbs. **Advantages:** The cutter head can be set and operated in any position—from vertical to horizontal. Machine combines the good points of the horizontal spindle machines, the vertical spindle machines, etc. In addition, cuts at all angles; it has a radial feed at all angles, and is first-class profiler and cam cutter. *It will save you dollars* in cutters, fixtures and time. Write for particulars.

WALTHAM WATCH TOOL CO., Factory and Office, Springfield, Mass.

CHAS. CHURCHILL & CO., London. SCHUCHARDT & SCHUTTE, Berlin, Brussels, Vienna.

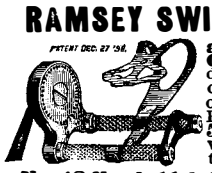
A NEW PROPOSITION:

WHEELS Built to Order $12

upwards from high-grade material and fittings of your own selection. **Send for illustrated catalogue of the famous TEMPLE & CROWN FRAMES** and all standard makes of bicycle parts and fittings, "make your selection," we build the wheel accordingly. **Lowest Prices—Guaranteed. Agents Wanted. Write today.**

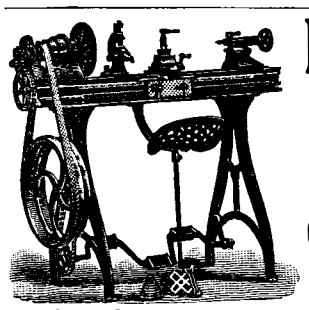
RALPH TEMPLE CO., 108 Lake St., Chicago.

RAMSEY SWINGING PEDALS



are the Pullman Cars of Cycling. No wheel is up to date without them. No dead center. Increased application of power. Fits any bicycle. Price, **$3.50. Toe Clips, 50c.** Send name and date of wheel. Booklet on application.

No. 48 North 11th St., Philadelphia, Pa.



Screw Cutting Lathes, 9 inch to 13 inch Swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.

SEND FOR CATALOGUE.

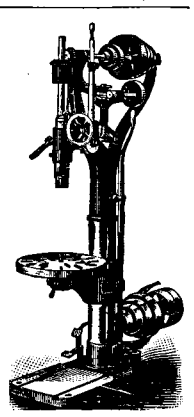
Barnes' Upright Drills.

Complete Line, 8 inch to 42 inch Swing.

SEND FOR CATALOGUE.

W. F. & Jno. Barnes Co.

1999 Ruby St., Rookford, Ill., U.S.A.



Solar Carriage Lamps

Burn Acetylene Gas.

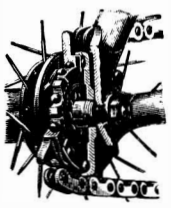
Are of real value in actual use. Besides being a signal, they LIGHT ALL THE ROAD. Indispensable for night driving. Just the thing for doctors or for the vehicle you take to the country.

Simple, Safe and Clean.

Price $9.00 and 15.00 per pair
Send for Catalogue.

Badger Brass Manufacturing Co., Kenosha, Wis.

© 1899 SCIENTIFIC AMERICAN, INC.



BEST BICYCLE BRAKE.

All cyclists, whatever wheel they ride, should have attached the **latest** and **best Automatic Coaster and Brake.**

The • Trebert • Brake

is composed of a friction disk secured to the hub of rear wheel, a clutch on the disk and a clutch on the rear sprocket wheel. Both clutches have inclined surfaces upon which balls roll. When the bike chain is pulled forward, the balls also move forward and ride up their incline. Back pressure to pedals produces reverse motion. Free booklet of particulars. Made only by the

TREBERT AUTOMATIC COASTER AND BRAKE CO.,

SYRACUSE, N. Y.

The Olive Bicycle

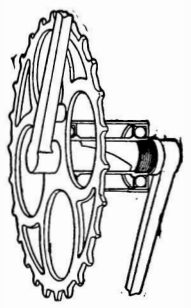
CONTAINS MERITS not found in other makes. A very Attractive, High Class, RELIABLE WHEEL, made of the Best Material and scientific construction.

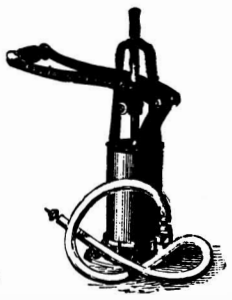
EQUIPPED WITH

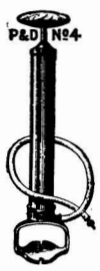
TREBERTS AUTOMATIC COASTER AND BRAKE.

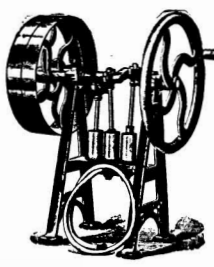
OLIVE WHEEL CO., 507 So. West Street,

SYRACUSE, N. Y., U. S. A.









GLEASON-PETERS AIR PUMP CO.

MANUFACTURERS OF **AIR PUMPS**

Cor. Houston & Mercer Sts., New York, U. S. A.

OAKMAN MOTOR VEHICLE CO.

Greenfield, Mass.

Hydro-Carbon Motor,

FREE FROM ODOR.

SPEED AT WILL.

ECONOMICAL,
SIMPLE,
DURABLE,
PRACTICAL,
NOISELESS,
ATTRACTIVE.

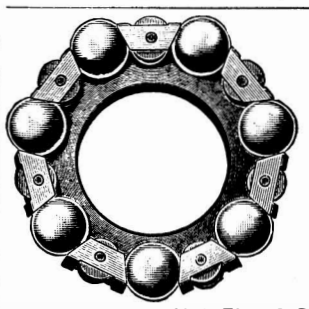
Weight, 475 Pounds.

5000 BICYCLES

Overstock. Must be closed out **Standard '99 Models** guaranteed, **$10** to **$25.** '98 & '97 models **$8** to **$15.** Shopworn and second hand wheels, good machines, **$3** to **$10.** Great Factory Clearing Sale. We ship anywhere, to any one, on approval and trial without a cent in advance.

EARN A BICYCLE by helping us advertise our superb wheels. Easy work and sure reward on our new plan. We will give one Rider Agent in each town **FREE USE** of Sample Wheel to introduce them. **Write at Once for Our Special Offer.**

G. C. MEAD CYCLE COMPANY, CHICAGO, ILL.



Mechanical Features

are those wherein **CLEVELAND BICYCLES** excel. Every year we bring out some entirely new mechanical improvements, and this season finds us with more good things than ever. One of these is the

BURWELL BALL AND ROLLER BEARING,

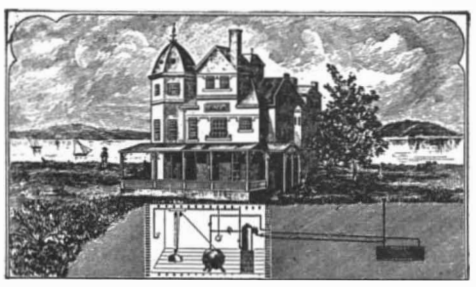
which has stood without injury, for more than sixty consecutive minutes, the remarkable test of **48,000 turns per minute**—four times the speed at which ordinary ball-touch-ball bearings become heated and go to pieces. This means the practical elimination of friction; consequently, the greatest possible ease of running, and qualities of endurance almost beyond conception. They are an exclusive feature of

CLEVELAND BICYCLES

H. A. LOZIER & CO., Mfrs.,

Cleveland, Ohio, U. S. A.

BRANCHES.—New York, Chicago, Boston, Philadelphia, Buffalo, Detroit, San Francisco, London, Paris, Hamburg.



Our remarkable recent inventions enable us to offer the public an intensely brillant, smokeless gas, at much less cost than city gas, better, safer and cheaper than electricity and costing but one-fourth as much as Acetylene. Most durable and least expensive apparatus to maintain in effective perpetual operation. Gives all services of lighting, cooking and heating. Fullest satisfaction guaranteed and easy terms. The very apparatus for suburban homes, institutions, etc. We construct special apparatus also for fuel gas for manufacturing, producing gas equivalent to city gas at 50 cents per 1,000 cubic feet and made to respond to very large demands, also for lighting towns, etc.

C. M. KEMP MFG. CO.

GUILFORD AVE. AND OLIVER ST., BALTIMORE, MD.

The Pipe of the Century

...THE... **"MALLINCKRODT" PATENT**

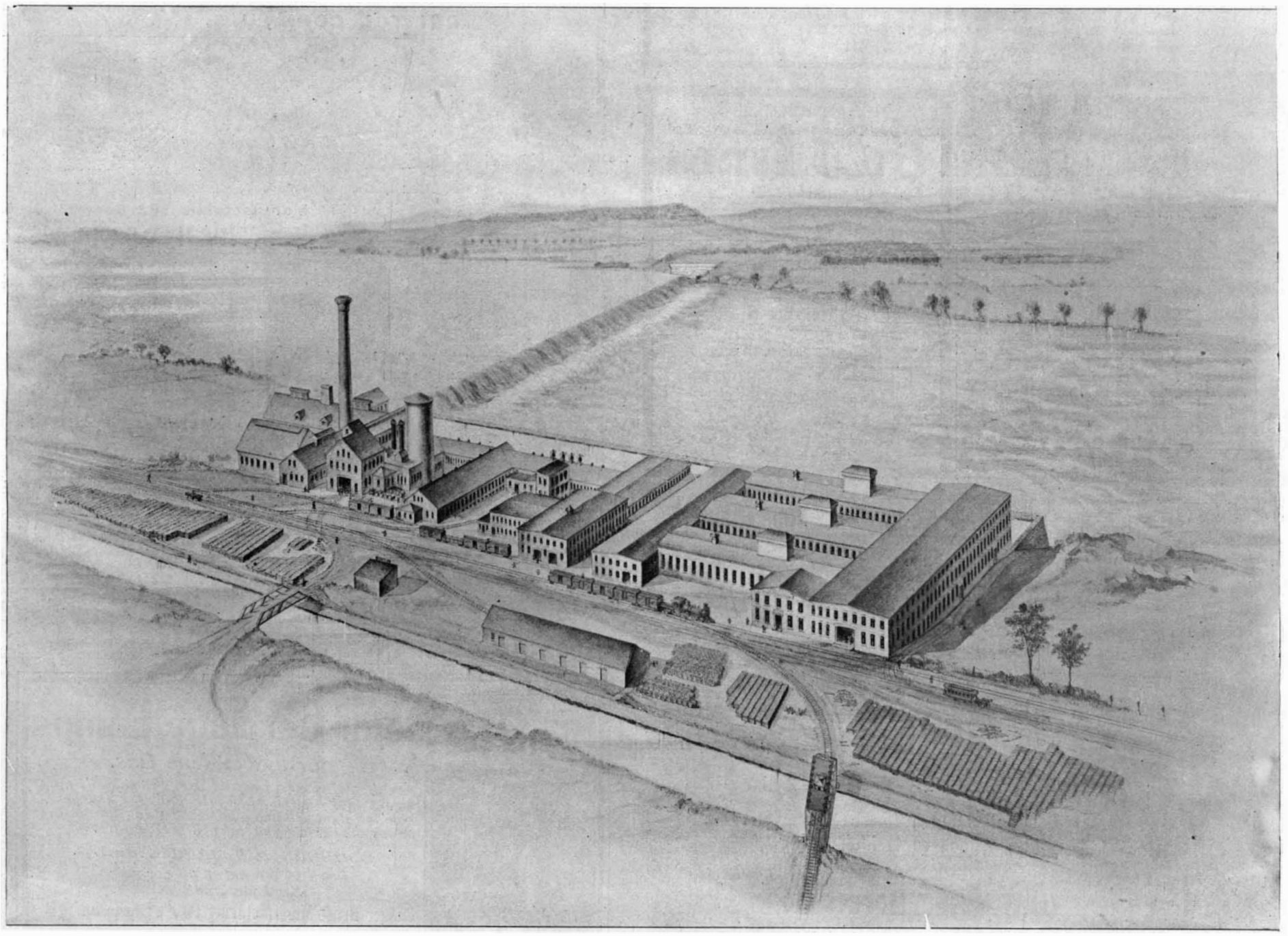
NICOTINE ABSORBENT AND VENTILATED SMOKING PIPE IS THE ONLY PIPE FIT FOR A GENTLEMAN TO SMOKE.

Bowls of the **Best French Brier,** exceedingly neat and graceful in appearance, they cost no more than an ordinary pipe. There are no filthy stems to clean, and by a simple and effective construction, the poisonous nicotine juices are thoroughly absorbed before reaching the mouth, and a cool, clean and healthy smoke thereby assured. Money refunded if not satisfactory. Over 100,000 sold in 1898 alone.

Send for Illustrated Circular "S. A." and prices.

THE HARVEY & WATTS CO.,

275 Canal Street, N. Y. Station E, Philadelphia.



GENERAL VIEW OF THE DUNCAN COMPANY'S PLANT ON THE HUDSON RIVER AT MECHANICVILLE, N. Y.

© 1899 SCIENTIFIC AMERICAN, INC.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

MAY 2, 1899,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adjustable bracket, R. Edmeades..... 624,001
Advertising attachment for music boxes, R. L. Stanton..... 624,397
Air brake safety attachment, A. C. Rumble..... 624,103
Air forcing or compressing device, F. W. Ensign 624,002
Alarm lock, W. C. Leet..... 624,345
Annealing furnace, W. & J. C. Swindell..... 624,401
Antifreezing apparatus, C. L. Brown..... 623,979
Asphalt, producing artificial, D. W. Peck..624,081, 624,082
Axle, carriage, W. H. Gailor..... 624,205
Back pedaling brake, A. A. Zalondek..... 624,284
Bag machine, Claussen & Elsas..... 623,983
Baling press, E. C. Sooy..... 624,112
Ball bearing wheel, T. C. Prouty..... 624,248
Band cutter and feeder, A. J. Heine.....624,023, 624,024
Banjo tailpiece, C. S. De Lano..... 624,309
Barium compounds, manufacturing soluble, C. B. Jacobs..... 624,041
Barrel, knockdown, R. M. Phillips..... 624,376
Basin, W. R. Chisholm..... 624,176
Bath. See Horse vapor bath.
Battery plate and producing same, secondary, A. J. Marquand..... 624,230
Beading machine hammering mechanism, Q. W. Booth..... 624,426
Bearing, adjustable, J. B. & J. B. Dunlop, Jr..... 623,999
Bearing, ball, E. Klahn..... 624,219
Bearings, manufacturing ball retainers for anti-friction, H. B. Keiper..... 624,047
Bed bottom, spring, F. Karr..... 624,341
Bed, combined sofa, F. C. Genge..... 624,008
Bed, folding, S. A. Wester..... 624,140
Bedstead, W. Coughlin..... 624,434
Beehive honey sections, separator for, J. E. Crane..... 624,438
Beer casks, apparatus for maintaining pressure in, C. E. Thurlow..... 624,129
Bicycle, D. Carpenter..... 624,295
Bicycle brake, A. W. Diehl..... 623,996
Bicycle brake, O. O. Zimmerman..... 624,285
Bicycle chain, W. A. Church..... 624,177
Bicycle handle bar, W. H. Castle..... 624,296
Bicycle handle bar, J. M. Marty, Jr..... 624,232
Bicycle propulsion, C. O. Anderson..... 623,962
Bicycle rack, E. S. Barnett..... 623,967
Bicycle rack, D. G. Martin..... 624,231
Bicycle saddle spring, J. S. Voltz..... 624,269
Bicycle signaling and tire inflating means, H. H. Pattee..... 624,079
Bicycle stand, W. H. Butler..... 623,981
Bicycle wheel, J. W. Armstrong..... 624,419
Binders, needle attachment for self, W. A. Glasgow..... 624,325
Boat, portable folding, J. Osmond..... 624,375
Boiler. See Water boiler.
Boiler furnace and connections, steam, H. Sieben..... 624,110
Boiler tube fastening, E. McGovern..... 624,367
Bolster, J. C. Wands..... 624,276
Book balance slip, check, E. Shaw..... 624,257
Book cover, E. D. Douglas..... 624,195
Book of address cards, J. B. Wiggins..... 624,280
Bottle, medicine, R. Frank..... 624,204
Bottle, non-refillable, H. S. Blynt..... 624,161
Bottle, non-refillable, J. M. Mott..... 624,235
Bottle, non-refillable, R. R. Reynolds..... 624,092
Bottle, non-refillable, R. H. Smith..... 624,393
Bottle, non-refillable, E. West..... 624,416
Bottle stopper, G. R. Moore, Jr..... 624,363
Bottle stopper, F. W. Schroeder..... 624,384
Bottle stopper locking device, P. Filteau..... 624,004
Bottle washing machine, J. R. Robb..... 624,097
Box. See Journal box. Mail box. Pasteboard box. Stuffing box. Thread box. Tote box.
Box handle, A. S. Held..... 624,025
Boxes, etc., fastener for, H. B. J. Andrus..... 624,286
Bracket. See Adjustable bracket. Lantern bracket.
Brake. See Back pedaling brake. Bicycle brake. Vehicle brake.
Brake shoe, A. L. Streeter.....624,262, 624,263
Brick machine, W. F. Stimpson..... 624,398
Bridge wing support, J. M. Jones..... 624,339
Broom head, J. J. Eck..... 624,310
Brush, G. B. Hussey..... 624,336
Brush, fountain, W. W. Lawrence..... 624,055
Buckle, back band, D. T. Bryan..... 624,431
Buggy top, G. P. Mitchell..... 624,066
Burner. See Gas burner. Hydrocarbon liquid burner. Oil burner. Vapor burner.
Burner tip, J. A. Vincent..... 624,133
Butter cutting machine, R. R. Stone..... 624,261
Button, C. H. Slocum..... 624,258
Button and necktie fastener, combined collar, J. H. Sherman..... 624,108
Button attaching machine, F. R. White..... 624,279
Button drilling machine, C. P. Johnson..... 624,216
Button making machine, W. J. Pugh..... 624,377
Buttons, etc., machine for turning pearl, Masson & Fortin..... 624,060
Cabinet, measuring and display, J. Tritz..... 624,406
Camera reversible back, H. W. Locke..... 624,057
Canopy frame, C. B. Baggett..... 624,152
Car and air brake coupling, combined, M. A. Williamsen..... 624,143
Car bearing, J. R. Baker..... 624,153
Car body bolster, Casey & Pries..... 624,174
Car brake apparatus, J. A. Norton..... 624,239
Car door, grain, Fink & Paplow..... 624,316
Car draught gear, railway, H. M. Perry..... 624,084
Car, gallery, Steffens & Koss..... 624,116
Car transom, M. B. Schaffer..... 624,255
Carbonating apparatus, F. D'Orbessan..... 623,997
Card, caricature, E. M. Levy..... 624,347
Carpet, J. Stevenson..... 624,123
Cartridge, F. K. Young..... 624,146
Chair. See Dental operating chair.
Chair seat, J. H. Coffman..... 623,985
Chalice holder, C. Forbes..... 624,005
Channeling comminutor, G. E. Surgi..... 624,400
Chutes, etc., machine for regulating flow in, C. H. Sutton..... 624,126
Cigar branding machine, F. J. Hagen..... 624,326
Cigar lighter, electric, W. F. Kessler..... 624,218
Circuit closure, automatic, G. A. Wall..... 624,272
Clip. See Singletree clip.
Clock, watchman's, A. E. Waggoner..... 624,413
Clothes suspender, folding, F. Weber..... 624,415
Cofferdam for screw propellers, C. A. Eicke..... 624,198
Collaret, H. G. B. Peters..... 624,085
Commutator bar, C. F. Brooker..... 624,167
Compound engine, C. J. Mellin..... 624,360
Concentrator, endless belt, J. Jacobs..... 624,215
Concrete mixing, transporting, and dumping apparatus, combined, I. H. Fisher..... 624,260
Cooking utensil, H. J. Halm..... 624,206
Cord holder, S. K. Dennis..... 624,190
Cord holders, etc., consisting of malleable or annealed iron having chilled portions, apparatus for founding, S. K. Dennis..... 624,191
Corner strip for protecting angles of plastered walls, metallic, W. F. Parker..... 624,076
Corset, C. M. Southworth..... 624,394
Corset fastener, A. Leeson..... 624,344
Cotton conveyer, R. C. Newell..... 624,237
Coupling. See Car and air brake coupling. Thill coupling.
Crate, folding, C. E. Freckleton..... 624,320
Cream separator, E. P. Doty..... 624,194
Cream separator, J. A. Rosback..... 624,100
Cream separator, centrifugal, C. F. Bertram..... 624,424
Creamery or cheese factory appliance, F. W. Moldenhauer..... 624,234
Crutches, canes, etc., tip for, J. S. Hawley, Jr.... 624,207
Cultivator, two wheeled tongueless riding, A. H. Maxwell..... 624,063
Cutlery, table, F. B. Rising..... 624,380
Cutter. See Band cutter.
Cylinder lock, H. G. Voight..... 624,411
Damper, fireplace, J. A. Kennedy..... 624,049
Damper, stovepipe, McSpadden & Railton..... 624,073
Dental disk holder, G. B. Hakins..... 624,015
Dental engine, C. S. Wardwell..... 624,137
Dental operating chair, A. F. Bogren..... 624,425
Display stand, McKenzie & Linsner..... 624,368
Door hanger, T. C. Prouty.....624,246, 624,247
Door stop, H. Fullwood..... 624,007
Dress or skirt protector, lady's, E. A. Stears..... 624,114
Drill. See Rock drill. Seed drill.
Drill and tap, combined, W. D. Balcom..... 624,156
Drill socket, A. Walter..... 624,274
Dye and making same, red brown monazo, K. Schirmacher..... 624,256
Electric line conductor, D. G. Stoughton...624,124, 624,125
Electric meter, R. S. White..... 624,141
Electric meters, means for reducing friction in rotating shafts of, R. S. White..... 624,142
Electric motor, H. W. Corse..... 623,989
Electric signal circuits, testing apparatus for, A. Coleman..... 624,300
Electrical rosette, A. P. Seymour..... 624,386
Electromagnetic actuating device, B. E. Chollar 624,299
Electropneumatic controlling system, G. Westinghouse..... 624,277
Elevator. See Material elevator.
Elevator attachment, E. Stoddard..... 624,260
Elevator car safety apparatus, C. F. Ritchell..... 624,098
Elevators, controller for electrical, B. C. Van Emon..... 624,409
Elliptic spring, J. S. Poyen..... 624,244
Engine stop, J. Brady..... 624,428
Engine stop mechanism, P. Eckenroth...624,311, 624,312
Engraver's block or work holder, H. C. Clark..... 624,179
Explosive compression engine, automatic, F. Burger..... 623,980
Fare register, G. Rein..... 624,091
Feed box grain saving attachment, E. M. Pumphrey..... 624,087
Feedwater heater and pump, locomotive, L. D. Copeland..... 624,303
Fence, wire, Jennings & Spradling..... 624,045
Fibers, apparatus for separating mixed, T. Lee.. 624,056
Firearm, W. H. Davenport..... 624,187
Firearm, automatic, F. K. Young..... 624,145
Firearm lock, A. Fyrberg..... 624,321
Firearm shell ejector, A. Fyrberg..... 624,322
Fire escape, Buddenbohn & Speer..... 624,432
Fire escape, A. V. Callahan..... 624,293
Floor set, W. M. Allen..... 624,147
Fluid motor, G. R. Bond..... 624,163
Flute or clarinet key mechanism, C. T. Howe..... 624,034
Fly paper cage, J. J. Requa..... 624,249
Fuel, A. Campbell..... 624,173
Fuel hopper, W. Swindell..... 624,402
Furnace feeder, steam boiler, D. B. Devore..... 623,993
Furnaces, fire brick arch for, H. S. Vrooman..... 624,270
Game, W. Henry..... 624,029
Game indicator, social, F. H. D. Cahnbley..... 624,172
Garment fastener, J. D. Conover..... 623,987
Gas burner, E. E. Slick..... 624,391
Gas burner, acetylene, L. M. Bullier..... 624,169
Gas burner, safety, F. Pairan..... 624,241
Gas burning heater, J. McCartney..... 624,071
Gas generating apparatus, acetylene, E. N. Dickerson..... 623,994
Gas generating apparatus, acetylene, E. A. Meyer..... 624,361
Gas generator, G. Wanderpepen et al..... 624,275
Gas generator, acetylene, A. Beveridge et al..... 624,159
Gas generator, acetylene, J. D. Forsyth..... 624,203
Gas generator, acetylene, Graf & Keck..... 624,011
Gasket for steam boilers and coupling therefor, A. W. Chesterton..... 623,982
Gear, change driving, F. G. Hampson..... 624,017
Gear, differential, R. F. Daly..... 624,186
Generator. See Gas generator.
Glass horse, C. Leng..... 624,346
Glass melting furnace, W. Buttler.....624,290, 624,291
Goblets, etc., machine for putting stems and feet on, O. Sigwart..... 624,389
Grade indicating and profile apparatus, E. A. Uehling..... 624,268
Graphophone, C. G. Conn..... 624,301
Graphophone sound reproducer, T. H. Macdonald..... 624,059
Grates, means for removing, H. P. Cope..... 624,185
Grinding, crushing, or pulverizing mill, Walker & Johnson..... 624,136
Grinding machine, Post & Goehring..... 624,086
Grinding machine, ball, C. C. Hill..... 624,032
Grinding mill, A. G. Wells..... 624,139
Gromet, B. L. Andrus..... 624,150
Gudgeons in wooden rollers, securing metal, F. F. Hoehne..... 624,212
Guns, grip for straight pull, A. S. Fitch..... 624,317
Hammer, drop, Rowbottom & Griggs..... 624,101
Hammock sling, I. M. George..... 624,324
Handcuff, L. H. Cobb..... 623,984
Handle. See Box handle.
Hasp, W. Ryno..... 624,105
Hat bands, adjustable clasp for mourning, E. A. Burt..... 624,170
Hat block chuck, G. F. Larkin..... 624,225
Hat fastener, H. Shourt..... 624,109
Hat, lady's, B. F. Koch..... 624,221
Headed articles of manufacture, forming, J. A. & A. L. Thierry..... 624,404
Headlight chimney protector, locomotive, J. F. Hare..... 624,328
Hoisting and dumping machine, G. H. Bowers... 624,288
Hoisting or lowering device, H. R. Patriarche, 624,077, 624,078
Hook. See Lacing hook. Whiffletree hook.
Hooping wooden vessels, device for, G. M. Clarke..... 624,178
Horse vapor bath, Atwater & Eldredge..... 624,420
Horseshoe bars, rolls for forming, E. Bumford... 624,433
House. See Malt house.
Hydraulic motor, A. H. Lighthall..... 624,352
Hydrocarbon liquid burner, H. Ogborn..... 624,372
Ice cream freezer clamping bench, R. Kirk..... 624,343
Ice marker, H. Bodenstein..... 624,162
Indicator. See Game indicator. Office door indicator. Pressure indicator.
Injector, F. Brunbauer..... 624,430
Ink well and device for opening or closing same, W. R. Hall..... 624,016
Iron. See Sad iron.
Journal box, car axle, J. D. Fullen..... 624,006
Knitting machine, W. S. Mills..... 624,065
Knob, bell door, B. F. Flowers..... 624,436
Labeling machine, can, W. D. Ayers..... 624,421
Lacing hook, G. A. Weld..... 624,138
Ladder and jack, combined step, D. Hughes..... 624,037
Lamp, acetylene, E. J. Dolan..... 623,998
Lamp, acetylene gas generating, C. W. Beck..... 623,974
Lamp, acetylene gas generating, F. W. Hedgeland..... 624,022
Lamp, acetylene gas generating, E. Moreau..... 624,068
Lamp burner cleaner attachment, gas, F. W. Hedgeland..... 624,210
Lamp, incandescent, A. Tillmes..... 624,265
Lamp, surgical, D. D. Smith..... 624,392
Lamps, device for igniting bicycle, carriage, or other, M. Tucker..... 624,267
Lantern bracket, F. Rhind..... 624,093
Latch, T. B. Stevens..... 624,121
Leveling rod, Millikin & Bowen..... 624,362
Lever, throttle, L. W. Canady..... 624,294
Liquid dispensing apparatus, A. Haye..... 624,208
Liquids, apparatus for charging bottles with, W. Hucks, Jr..... 624,335
Liquids from bottles, etc., apparatus for drawing off aerated, T. Ferguson..... 624,199
Lock. See Alarm lock. Cylinder lock.
Loom, W. G. Eaton..... 624,197
Loom, J. H. Northrop..... 624,371
Loom, swivel, G. F. Hutchins..... 624,039
Loom warp stop motion, Baker & Kip..... 624,155
Loom warp stop motion, Robinson & Piron..... 624,252
Looms, electrical warp stop motion for, Baker & Kip..... 624,154
Magnifying glass frame, G. W. Bennum..... 623,975
Mail box, S. A. Bragunier et al..... 624,289
Malt house, W. H. Prinz..... 624,245
Mangle, A. Conkling..... 624,180
Marine engine, A. H. Lighthall.....624,348, 624,351
Marking cattle, apparatus for, Hellbardt & Gerhardt..... 624,026
Match safe, J. Lindgren..... 624,354
Material elevator, H. Cull..... 623,990
Mechanical movement, J. Konar..... 624,052
Metal hooks, making wrought, F. J. Monz..... 624,067
Metal, rustless, H. S. Taylor..... 624,127
Metal tube, F. A. Wilmot..... 624,144
Metals from their solutions, reducing, C. B. Jacobs..... 624,040
Metallic sulfids, reducing, J. Durie..... 624,000
Meter. See Electric meter.
Mill. See Grinding mill.
Mining device, C. Wright..... 624,281
Moisture, apparatus for preventing condensation of, E. H. Maule..... 624,358
Motor. See Fluid motor. Electric motor. Hydraulic motor.
Mowing machine, front cut, P. F. Hodges..... 624,334
Naphtha retort safety device, J. V. Rice, Jr..... 624,094
Nozzle, exhaust, Mattews & Andricht..... 624,062
Nut lock, W. W. Perkins..... 624,083
Office door indicator, O. W. Whaley..... 624,278
Oil burner, J. S. Thurman..... 624,130
Oil burner, crude, Long & Walling..... 624,058
Oiler, W. H. Wyler..... 624,282
Oiler and cooler, automatic journal, A. C. Rumble..... 624,102
Oiler, hand, G. S. Huff..... 624,035
Ophthalmometer, R. H. Satterlee..... 624,106
Organ, reed, J. H. Dickinson..... 624,192
Packing, piston, G. M. Mullen..... 624,365
Paper, perforating and winding machine, W. P. Kidder..... 624,050
Pasteboard box, J. Unser..... 624,408
Photographic background carrier, C. A. Snow.... 624,111
Photographic film, F. C. Axtell..... 623,963
Photographic finder, W. Mayo..... 624,359
Photographic lighting apparatus, G. Bouillaud... 624,164
Piano, electric, Schrade & Shonnard..... 624,382
Pictorial reproduction, J. Jacobson..... 624,042
Pin. See Safety pin.
Pipe fitting, C. W. Dietrich..... 624,193
Pipe scraper, S. Crawshaw..... 624,307
Pipe trimmer, G. Klahre..... 624,051
Pipe wrench, H. Rudebock..... 624,253
Plaiting machine, T. F. Hagerty.....624,013, 624,014

(Continued on page 320)

PURE WATER
PURE WATER IS THE GIFT OF GOD TO THE LIFE HE HAS CREATED
IMPURE WATER IS THE CAUSE OF MORE THAN HALF THE DISEASES OF MAN

Ralston Still.

A delight to every woman's heart. Supplies the table with an abundance of Sparkling, Pure Water, sterilized and aerated by a new process, and absolutely free from all germs of disease, poisonous gases and old age matter. Purifies the most infected water without trouble or expense by utilizing the waste heat of the kitchen range. No larger than a tea-kettle, and as easily cleaned. New 1899 Model with all latest improvements, plated finish, etc., only **$10.00.** Guaranteed the best in the world—best in workmanship and construction, easiest to operate, and with the largest capacity per hour. If found otherwise, may be returned at our expense.

Officially Adopted by the Ralston Health Club.
Highest Award and Gold Medal at Omaha Exposition.
Extensively Used by the U. S. Government.
Over 1,000 Testimonials from Satisfied Purchasers.

☞ Send for Booklet "B," list of dealers and other interesting printed matter. Manufactured only by

THE A. R. BAILEY MFG. CO., 54 MAIDEN LANE, NEW YORK.

On Receipt of Ten Cents in Stamps (practically 25% of retail price) **we will send you one of our**

1-2 INCH AUGER BITS

A fine cutting tool, perfect clearance, especially good in hard wood and for end boring. *Send for Cir. S. A., free.*

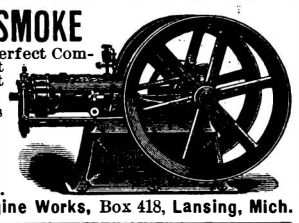
THE FORD BIT CO., HOLYOKE, MASS.

NO BLACK SMOKE

at Exhaust Pipe, Perfect Combustion, Highest Efficiency, Greatest Economy.

Olds Mixer is found only on **Olds Gasoline Engines.**

New catalogue just out.



Olds Gasoline Engine Works, Box 418, **Lansing, Mich.**

POWER & FOOT LATHES. | SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE.

SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

This beats Wind, Steam, or Horse Power. We offer the **WEBSTER 2½** actual horse power

GAS ENGINE

for **$150,** less 10% discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100 therefore we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline. Also Horizontal Engines, 4 to 30 horse power.

☞ *Write for Special Catalogue.*

WEBSTER MFG. CO., 1074 West 15th St., CHICAGO
Eastern Branch, 38-D Dey Street, New York City.
Southern Agents: Boland & Gschwind Co., Ltd., So. Peter and Lafayette Sts., New Orleans, La.

Economy Drilling Compound

Superior to Oil or other Lubricants.

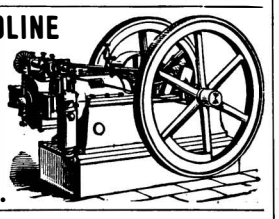
Keeps Tools Cool and Sharp, Produces Smooth Work and Fine Finish, is Clean and Does Not Rust or Gum. Adopted by U. S. Government, Railroads, and Leading Manufacturers. Barrels, 7c. a lb. Half-Barrels, 8c. a lb. Freight prepaid. Sent on approval.

THE WHITE & BAGLEY COMPANY,
WORCESTER, MASS., U. S. A.

GAS and GASOLINE ENGINES.

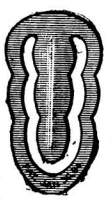
Using Natural Gas, Coal Gas, Producer Gas, and Gasoline direct from the tank. 1 to 40 H. P., *actual.*

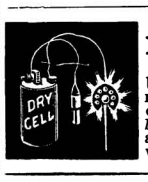
The Springfield Gas Engine Co.
21 W. Washington St.
Springfield, O.



THE EUREKA CLIP

The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by **Consolidated Safety Pin Co.,** Box 121, **Bloomfield, N. J.**



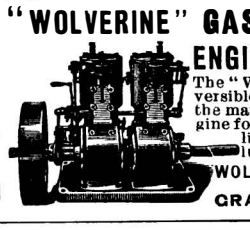


"NEW STANDARD" NECKTIE PIN OUTFIT.

By mail, prepaid, ONE DOLLAR.

Unlike all others. The smallest, neatest and most durable ever placed on the market. *Liberal discount to jobbers.* WILLIAM ROCHE, Inventor and Sole Manufacturer. 259½ Greenwich Street, NEW YORK, U. S. A.

"WOLVERINE" GAS AND GASOLINE ENGINES, STATIONARY and MARINE.



The "Wolverine" is the only reversible Marine Gas Engine on the market. It is the lightest engine for its power. Requires no licensed engineer. Absolutely safe. Manufact'd by

WOLVERINE MOTOR WORKS,
12 Huron Street,
GRAND RAPIDS, MICH.

This double-slope causes the expanding ice to slide into the air-dome, taking the strain off the pipe. The air-cushion also prevents "Hammering." Covered by U. S. and Foreign Patents.

Burst Water Pipes a Thing of the Past

You can now make all water pipes as secure from bursting in winter as in summer. This pneumatic system is the only one which successfully prevents the annoying and costly bursting of water pipes. It has solved a great economic problem. Highly endorsed by Architects, Engineers and Municipal Officials. No new house should be completed without this system, and all house owners should avail themselves of this "ounce of prevention" in season.

☞ *Send for Illustrated Booklet, giving full explanation and discount.*

THE PNEUMATIC DOME MANUFACTURING COMPANY,
501 E Street, Northwest, Washington D. C.

Every Tool for Every Use

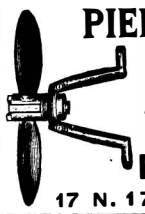
A complete list of all the Tools made for any and every purpose, all fully described and accurately illustrated will be found in the 1898 edition of **MONTGOMERY & CO.'S**

TOOL CATALOGUE.

It contains 510 closely printed pages with index. Book is pocket size, 6¼ x 4¼ inches, with rounded edges and stitched covers. Sent free by mail on receipt of 25 cents by

MONTGOMERY & CO.
105 Fulton Street, New York.

PIERCE REVERSIBLE Speed Propellers



ALL BRONZE 13 TO 24 IN.

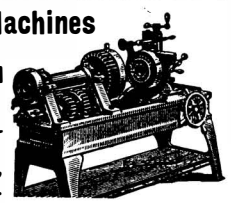
☞ *Send for circulars and prices.*

PIERCE ENGINE CO.,
17 N. 17TH STREET, RACINE, WIS.

Pipe Threading Machines

of Highest Merit.

COMBINATION BENCH and PIPE VISES.



Catalogue containing interesting information free.

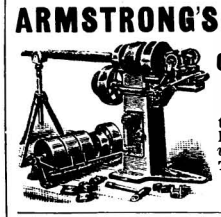
Bignall & Keeler Mfg. Co.,
Box S., Edwardsville, Ill.

GREAT POWER—SMALL COST!

The maximum of strength, durability and safety, with the minimum of cost that describes our **HOISTING ENGINES** for operation on Gasoline, Distillate or Crude Oil. Every part of the engine is interchangeable. Soon saves its cost in fuel alone. Both friction and geared hoist, 6 to 150 H. P. For quarries, mines and docks. *Send at once for free catalogue.*

Weber Gas & Gasoline Engine Co., 402 S.W. Boulevard, **Kansas City, Mo.**

ARMSTRONG'S PIPE THREADING
—AND—
CUTTING-OFF MACHINES

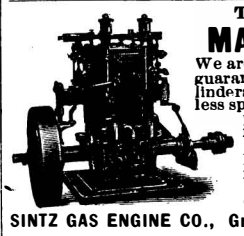


Both Hand and Power.
Sizes 1 to 6 inches.

Water, Gas, and Steam Fitters' Tools. Hinged Pipe Vises. Pipe Cutters. *Stocks and Dies universally acknowledged to be* THE BEST. ☞ *Send for catalog.*

THE ARMSTRONG MFG. CO.
Bridgeport, Conn.

THE IMPROVED MARINE ENGINE



We are the oldest builders and guarantee superiority. Two cylinders in one casting. Occupies less space and weighs less for its power than any engine made. Can be used wherever power is required. Either stationary or marine. No fire, no heat, no smoke. No licensed engineer required. *Send for cat.*

SINTZ GAS ENGINE CO., Grand Rapids, Mich., U.S.A.

BUILDERS AND DESIGNERS

SPECIAL MACHINERY

C. H. Cowdrey Machine Works,
5 Main St., Fitchburg, Mass.

IT TELLS "WHICH WAY"

The only Pocket Level that shows at a glance "where" work is out. Size of a silver dollar, ⅜ in. thick, nickeled. Sample 70 cents. *Caliper catalog free.*

E. G. SMITH, Columbia, Pa., U. S. A.

Satisfaction Guaranteed

We feel so certain of our ability to satisfy you both as to quality of goods and price that we do not hesitate to ship for inspection, guaranteeing satisfaction. We are further justified in this position by our 26 years of experience. Could anything be more fair?

We are the largest manufacturers of vehicles and harness in the world selling to the consumer exclusively.

WE HAVE NO AGENTS.

We have no desire to increase the cost to you by this or other means; hence we sell you direct from our factory at wholesale prices. We are not jobbers or dealers. **We make everything we sell.** Largest selection—170 styles of vehicles, 65 styles of harness.

No. 521—Canopy-Top Duplex Wagon, with curtains all around, storm apron and pole or shafts. Price $50 as good assells for $80.

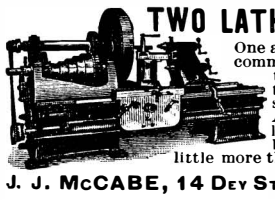
No. 145—Double Spring Wagon Harness. Price $20.75; as good as retails for $28.

SEND FOR LARGE FREE ILLUSTRATED CATALOGUE.

Elkhart Carriage and Harness Mfg. Co., W. B. Pratt, Sec'y, Elkhart, Indiana.

© 1899 SCIENTIFIC AMERICAN, INC.

McCabe's Pat. Double Spindle Lathe



TWO LATHES IN ONE.

One a 26-inch swing for the common run of work, and the other a powerfully **triple-geared** 44-in. swing for heavy work. A substantial, carefully designed and well built tool. Costs but little more than an ordinary lathe.

J. J. McCABE, 14 Dey Street NEW YORK.

Buy Telephones

THAT ARE GOOD--NOT "CHEAP THINGS."
The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits. Our guarantee and instruments are **both good.**
WESTERN TELEPHONE CONSTRUCTION CO.
250-254 South Clinton St., Chicago.
Largest Manufacturers of Telephones exclusively in the United States.

"American-Hunnings" TELEPHONES.

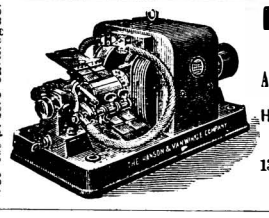
Transmitters, Magneto Bells and Telephone Switchboards. Over **200,000** of our telephones in successful operation. Used by War and Navy Departments. In ordering state length of line, whether single line or metallic circuit and number of telephones to be used on one line. ☞ *Send for catalogue "S. A."*
AMERICAN ELECTRIC TELEPHONE CO.,
173 South Canal St., Chicago, Ill.

The Coburn Patent Trolley Track

Store Ladders.

A PAIR OF STAIRS ALL ALONG THE LINE OF SHELVES.
☞ *Send for Book.*
The Coburn Trolley Track Mfg. Co.
HOLYOKE, MASS.

Send your business card for 100 p. 1898 catalogue.



NICKEL AND Electro-Plating

Apparatus and Material.
THE Hanson & VanWinkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St. Chicago.

ROCK DRILLS
AIR COMPRESSORS
SIMPLEST. MOST EFFICIENT and DURABLE.
RAND DRILL CO.
Send for Catalogue. 100 Broadway, New York.

If You Want the Best Lathe and Drill

CHUCKS

BUY WESTCOTT'S *Strongest Grip, Greatest Capacity and Durability, Cheap and Accurate.*
Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

The Yankee DRILL GRINDER

for grinding both Twist and Flat Drills. Grinds all sized drills from 1/8 to 2 1/4 in. Can be set for any size in a few seconds. Gives any desired clearance. Fully guaranteed.
"Can't Grind Wrong." *Catalog free*
G. T. EAMES COMPANY,
250 Asylum Ave., Kalamazoo, Mich.

INSIDE MICROMETER.

For close internal measurements.
Reads in thousandths. Capacity 2 1/2 in. to 10 in., with five rods. **Price $2.00.**
☞ *Catalogue of Fine Tools free.*
THE L. S. STARRETT CO. Box 13, Athol, MASS. U. S. A.

THE OBER LATHES

For Turning Axe, Adze, Pick, Sledge, Hatchet, Hammer, Auger, File, Knife and Chisel Handles, Whiffletrees, Yokes, Spokes, Porch Spindles, Stair Balusters, Table and Chair Legs and other irregular work.
Patented. ☞ *Send for Circular A.*
The Ober Lathe Co., Chagrin Falls, O., U. S. A.

Queen Transits and Levels

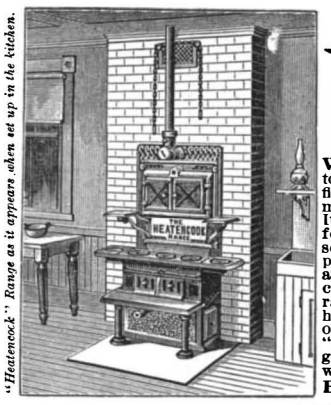
High Grade Instruments with the Latest Improvements.
160 page Engineering Catalogue on application. THE QUEEN 240 page Mathematical Catalogue on application.
ENGINEERS' AND DRAFTSMEN'S SUPPLIES.
QUEEN & CO., Optical and Scientific Instrument Works,
59 Fifth Ave., New York. 1010 Chestnut St., Phila.

PRESSES, DIES and Special Machinery

For Sheet Metal Workers.
West Mfg. Co., Buffalo, N.Y., U.S.A.

Plaster of paris casts, treating, A. Broodsky..... 623,978
Plow weed turner, A. A. Marsh..... 624,357
Pneumatic carrier system, E. A. Fordyce..... 624,202
Pneumatic dispatch apparatus, B. C. Batcheller..... 623,970, 623,971
Pneumatic dispatch apparatus carrier, B. C. Batcheller..... 623,972
Pneumatic dispatch tube system, E. A. Fordyce. 624,201
Pneumatic propulsion means, J. C. Walker..... 624,271
Pneumatic transit tubes, carrier receiving mechanism for, B. C. Batcheller..... 623,973
Pneumatic transmission system, B. C. Batcheller..... 623,968, 623,969
Pocket, safety, M. M. Murray..... 624,061
Potash, making yellow prussiate of, W. Schroder 624,383
Potato bug exterminator, E. L. Brillhart..... 623,977
Power transmitting mechanism, W. E. Curtis... 623,992
Power transmitting mechanism, D. Rudomin.... 624,381
Press. See Baling press.
Pressure indicator, mean effective, G. F. Atwood 624,151
Price list, C. Rust, Jr..... 624,254
Prints, process of and apparatus for producing irisated, J. M. Heppler..... 624,030
Propelling mechanism, vessel, T. Murphy..... 624,366
Propulsion, marine, A. H. Lighthall..... 624,353
Pump for compressing air, A. Roesch..... 624,099
Pumping apparatus for deep wells, Moore & Elder..... 624,364
Puzzle, W. J. Barrett..... 624,158
Rack. See Bicycle rack.
Racking apparatus, beer, H. W. Colby..... 623,986
Railway, E. M. Boynton..... 624,427
Railway chronograph, H. G. Sedgwick..... 624,385
Railway, electric, H. B. Cox..... 624,304
Railways, automatic safety appliance for, G. S. Jeffries..... 624,337
Raisin seeder, C. N. Holden..... 624,213
Refrigerating case for transporting frozen goods, portable, D. Brun..... 624,168
Refrigerator, F. E. Ranney..... 624,089, 624,090
Refrigerator, shipper's, J. O. Bowdish..... 624,165
Regenerative furnace, F. Siemens..... 624,388
Rein and hitching strap holder, T. Lee..... 624,226
Retort for drying sewage matter, W. H. Bowers. 624,166
Riveting engine, J. Fielding..... 624,435
Roasting furnace, H. A. Keller..... 624,048
Rook drill, H. V. Conrad..... 624,181
Rolling copper forms, machine for, C. F. Brooker 624,429
Roof fastening device, slate, C. A. Contant..... 623,988
Sad iron, self heating, F. G. Lawrence..... 624,054
Safety pin, R. Shedenhelm..... 624,387
Sand paper, W. Black..... 624,160
Sash fastener, H. G. Voight..... 624,412
Sash holder, H. Pracht..... 624,243
Saw handle, C. W. Byham..... 624,292
Saw jointer, E. J. Hicks..... 624,332
Scale, self weighing, A. W. B. Johnson..... 624,338
Scale, weighing, F. B. Mellinger (re-issue)..... 11,738
Screen. See Window screen.
Seal and tag, car, H. A. Kennedy..... 624,217
Seed cup, G. A. Heath..... 624,021
Seed drill, W. Stephenson..... 624,117
Seed drill, disk, W. Stephenson..... 624,118
Seed drill scraper, disk, W. Stephenson..... 624,119
Separator, F. Hixson..... 624,333
Sewers, flushing and cleaning, H. C. Davis..... 624,188
Sewing machine attachment, A. Nolan..... 624,238
Sewing machine for stitching eyelets, P. Krippendorf..... 624,223
Shade and curtain holder, window, E. McPherson..... 624,236
Shade finder, G. K. Henderson..... 624,331
Shade holder, adjustable, J. A. Smith..... 624,259
Shafts, apparatus for making crank, J. P. Harrington..... 624,019
Sharpener, knife, G. F. Ballou..... 624,437
Shears joint, J. W. Chapman..... 624,175
Shed, cattle, W. Heaton..... 624,330
Sheet feeding machine, automatic, G. F. Leiger. 624,229
Sheet feeding machine, pneumatic, G. F. Leiger.. 624,228
Sheet separating and feeding machine, pneumatic, G. F. Leiger..... 624,227
Shelf, table, or desk, folding wall, F. A. Steele... 624,115
Shoe upper fastener, A. H. Baker..... 624,287
Shutter fastener, C. H. Pease..... 624,080
Signaling apparatus, controller for electrical train, W. A. Stambaugh..... 624,396
Signaling system, electric, E. S. Simms..... 624,390
Singletree clip, F. E. Lack..... 624,053
Siphon, automatic, C. F. L. McQuistion..... 624,370
Skirt supporter, M. Cahill..... 624,171
Skylight, W. J. P. Kingsley..... 624,342
Soft coal furnace, A. W. Glessner..... 624,009
Spectacles, J. McLernon..... 624,369
Spinning frame attachment, A. C. Allgood..... 624,148
Spinning textile fibers, apparatus for, Todd & Stott..... 624,132, 624,266
Spray attachment, R. Orford..... 624,240
Spring. See Elliptic spring. Vehicle spring.
Spring shackle and oil distributer, R. A. Hammond..... 624,327
Stairway, G. C. Tilyou..... 624,405
Stamp, hand, J. A. Heany..... 624,020
Stand. See Display stand. Tripod stand.
Steam and hot air heater, combined, J. Demarest 624,189
Steamboat, D. Fletcher..... 624,318
Steam engine, I. N. Moore..... 624,233
Steel planing machine, tool, Masson & Fortin 624,061
Stenciling or decorative device, A. Haberstroh.. 624,012
Stereograph, J. Jacobson..... 624,043
Stopper. See Bottle stopper.
Stoves, folding plate for gas, R. H. Horne..... 624,214
Stuffing box, water gage, J. R. Crabill..... 624,305
Sulfureted hydrocarbons and making same, tasteless compound from, L. O. Helmers....624,027, 624,028
Suspender attachment, G. H. Tuthill..... 624,407
Tachometer, vibrating, B. C. Ball..... 623,965
Tag holder, M. Z. Villefeu..... 624,410
Tagging machine, tobacco, J. R. Cook..... 624,183
Tap, collapsible, W. D. Balcom..... 624,157
Target trap, A. M. Jenkins..... 624,044
Telephone, permanently adjusted, E. H. Thielscher..... 624,178
Telephone register, H. T. Richards..... 624,095
Telephone switchboard, J. M. Overshiner..... 624,075
Temperature regulating apparatus, W. S. Johnson..... 624,046
Thermostat, A. Roesch..... 624,098
Thill coupling, I. F. Hauff..... 624,329
Thimble, thread cutting, sewing, E. H. Randell.. 624,088
Thread box, M. J. Edwards..... 624,313
Threshing machine, H. A. Rands..... 624,378
Tire, cushion, J. F. Finin..... 624,315
Tire, wheel, J. J. Farrar..... 624,314
Tires, pump for inflating pneumatic, Wickersham & Jamison..... 624,417
Toasting and broiling apparatus, Lurie & Biloon. 624,356
Toe calks, apparatus for manufacturing, Childs & Sangster..... 624,298
Tongue attachment, wagon, L. Spaulding..... 624,395
Tool driver, spiral, H. M. Stevenson..... 624,122
Tote box, W. G. Avery..... 623,964
Toy, J. G. Roberts..... 624,251
Toy, mechanical, R. Teichmann..... 624,403
Track sanding devices, sand box for, F. W. Tildon..... 624,131
Tramway switch mechanism, overhead, J. H. Cook..... 624,302
Trap. See Target trap.
Trimmer. See Pipe trimmer.
Tripod stand, Jones & Mayo..... 624,340
Truck, barrel, T. T. Dickerson..... 623,995
Truss, C. D. Speagh..... 624,113
Tube. See Metal tube.
Typewriter, W. C. Chapman..... 624,297
Typewriter instruction, method of and apparatus for, C. W. Barkley..... 623,966
Typewriter ribbon feed reversing mechanism, G. A. Seib..... 624,107
Typewriters, paper carriage and index mechanism for, F. X. Wagner..... 624,135
Typewriting machine, H. L. Gaveau..... 624,323
Upholstering appliance, H. Voight..... 624,134
Valve gear, engine, F. X. Drolet..... 624,196
Valve, water gage glass, S. Cook..... 624,184
Vapor burner, incandescent, J. A. Yarton..... 624,283
Vapor engine, E. L. Lowe..... 624,355
Vehicle brake, Miller & McDonough..... 624,064
Vehicle fan attachment, Krause & Brachhausen. 624,222
Vehicle, motor, J. N. Forbes..... 624,319
Vehicle motor wheel, J. W. Walters..... 624,414
Vehicle running gear, G. Thomas..... 624,264
Vehicle spring, elliptic, S. C. Hitchcock..... 624,033
Vehicle washer, overhead, J. P. Baird..... 624,423
Vehicle washing hose, cutoff device for, J. P. Baird..... 624,422
Vehicle wheel, J. A. Heany..... 624,209
Vehicle wheel, W. Hulslander..... 624,038
Vehicles, controller for electrically propelled, E. B. W. Reichel..... 624,250
Velocipede fork crown, F. A. Cook..... 624,182
Voting machine, Cunningham & Major..... 623,991
Wagon, weighing chute, C. Bernhardt..... 623,976
Washboard, J. Sternad..... 624,398
Washer. See Vehicle washer.
Washing machine, H. Kleiman..... 624,220
Washing machine gearing, A. H. Herron..... 624,031
Watch roller remover, E. N. Parker..... 624,242
Water boiler, electric, J. C. Cramer..... 624,306
Water closet flushing apparatus, A. La Bonte.... 624,224
Water heater, J. McCartney..... 624,070
Water wheel, A. H. Lighthall..... 624,350
Water wheel bucket or vane, A. H. Lighthall..... 624,349
Web feeding and pasting mechanism, L. C. Crowell..... 624,308
Weighing apparatus, L. D. Orr..... 624,374

(Continued on page 321)



"Heatencook" Range as it appears when set up in the kitchen.

THE "HEATENCOOK" RANGE

HOUSE HEATING FROM
THE KITCHEN FIRE BY HOT WATER.

The "Heatencook" Range is a **Combined Cooking Stove** and **Hot Water Heater.** It is unequaled as a cook stove. It bakes, roasts, etc., to perfection. The range is made in the most substantial manner and is finished in first-class style. It is not an ordinary range with an attachment, but is designed especially as a beater and cooking stove combined. It weighs 2000 lbs. and is six feet high. An adjustable fire-pot is provided for summer or winter use. It is perfect in all respects, and is protected by several patents. **The house is heated by hot water.** Radiators are placed in the different rooms and connected to the "Heatencook" by flow and return pipes. In summer time the radiators remain full of water, the circulation of water being stopped by closing valves attached to each radiator, the radiators remaining cold. The "Heatencook" system will heat an entire house of moderate size—only one fire in the house. Plenty of hot water for bath and kitchen sink. Very economical in fuel. The "Heatencook" has been in use for five years. About 1000 ranges are now giving the greatest satisfaction in many most delightful homes. It is just what you want. Send for catalogue and get all particulars. Address
BROOMELL, SCHMIDT & CO., Limited, Box 135, **YORK, PA.**

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches & Elevators
PROVIDENCE R. I.

For Heavy Continuous Work

every machine shop will commend our **Power Pipe Threading and Cutting Machine.** Cones are central over machine, equalizing the weight. Within the cones are compound gears giving six changes of speed. Gears require no extra space, and are protected from dust or accident. Chasers can be opened, threaded pipe removed, another inserted and cut without stopping machine. ☞ *Send for Catalogue.*
THE MERRELL MFG. CO.
501 Curtiss Street, TOLEDO, OHIO.

MAGAZINE PLATE HOLDERS

THE FOLMER & SCHWING MFG CO.
271 CANAL STR. NEW YORK.

CUFFS HELD...

with the **Improved Washburne Patent Cuff Holders** can be placed just where you want them; will never slip but may be instantly released. Drawers Supporters, easily adjusted or taken off—excellent for holding golf trousers. By mail, 20c. the pair. ☞ *Catalogue showing these and other novelties, free.*

American Ring Co., Box P. Waterbury, Conn.

PHOTOGRAPHERS TRY TOLIDOL

For Dry Plates and Bromide Papers. Acts rapidly, is stainless and can be used repeatedly. Tubes for amateurs ready for immediate use, 25c. Pure Tolidol for professionals, 60c. ounce. Recommended by plate manufacturers. Dealers sell it. Haller-Kemper Co., Atlas Block, Chicago

A $5 PRINTING PRESS

will print your cards, labels etc. Saves you money. Large circular press $18. Full printed instructions for use. ☞ *Catalogue and samples free.*

KELSEY & CO., Mfrs., Meriden, Conn.

THE NEW BRISTOL COUNTER

Registers an accurate account of work done on printing presses, grain tallies, weighing, measuring and other automatic machines. Counts up to 1,000 000 and repeats automatically. Simple, accurate, durable. Special counters to order. ☞ *Send for circular.*
C. J. ROOT, Bristol, Conn., U. S. A.

The Telephone Magazine

CHICAGO.—Only paper published on *Telephone Exchanges* and *Apparatus*, Line Construction, Interior Wiring, Signaling Devices, *Telephone Troubles* and *How to find them* and many other instructive features. Handsomely illustrated. $1.00, sample 10c. Wanted: Bright, pushing agents. Write for terms and territory.
Marquette Building, CHICAGO, U. S. A.

It's Easy to Mail a Dollar

and get by return post one of the handsomest Bicycle Bells ever seen. Your choice of
Lion, Serpent, Turtle or Dragon.
Accurately modeled, finely hand-chased.
$1.00 Each. **$1.00 Each.**
Handsome jeweled eyes. Finish, antique bronze, and patent lock clamp.
Send for Catalogue "General Cycle Sundries."
The New Departure Bell Co., Bristol Conn.

THE HARRINGTON & KING PERFORATING CO.

LARGEST MANUFACTURERS IN THE WORLD OF PERFORATED METALS
STATION "F" CHICAGO. U.S.A.

WE WANT **YOU** to send us your name and your neighbor's name and address as we would like to send **EVERY GOOD FARMER**
A FREE SAMPLE COPY OF THE
Agricultural Epitomist
For the busy, practical working farmers of America. It is their paper and claims their support. **Don't Fail to Write us at Once Giving Addresses; Postal Will Do.**
AGRICULTURAL EPITOMIST, Indianapolis.

Others Say
many pleasant things about
Imperial Wheels
—the go-lightly kind.

Among the many Mr. T. Worden, 28 McArthur St., Detroit, says: "I rode my Imperial 15,000 miles in three years, and did not spend a cent for repairs." It is the wheel for those who like easy, safe riding. Special inducements to riders. Write for catalogue.
Ames & Frost Company, Chicago.

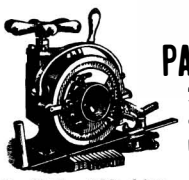
WOODWORKING MACHINERY.

For Planing Mills, Carpenters, Builders, Furniture, Chair, Vehicle, Wheel and Spoke Makers, etc.
☞ *Correspondence Solicited.*
Illustrated 312-page Catalogue free to manufacturers and foremen.
THE ECAN CO.
327 to 347 West Front Street, CINCINNATI, OHIO.

Monarch Bicycles

$25 $35 $50
The World's Favorite
AGENTS EVERYWHERE.
Monarch Cycle Mfg. Co.
Chicago. New York.

THE FORBES PATENT DIE STOCKS.



Two and three inch pipe can be threaded by a boy using only one hand on a crank.
☞ *Send for illustrated catalogue*
No. 30 Hand Machine. Range 1/4 to 2" R. & L.
CURTIS & CURTIS,
6 Garden St., Bridgeport, Conn.

BEST MACHINES

for **DRYING** Grain, Sands, Clays, Fertilizers, Coffee, Wet Feeds, Chemicals, Salt, Sugar, etc. Also **COFFEE HULLERS and CLEANERS.**
☞ *Send for 6th Illustrated Catalogue.*
S. E. Worrell, Hannibal, Mo., U. S. A.

DO YOU USE GRINDSTONES?

If so, we can supply you. All sizes **mounted** and **unmounted,** always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

Look to the Water You Drink

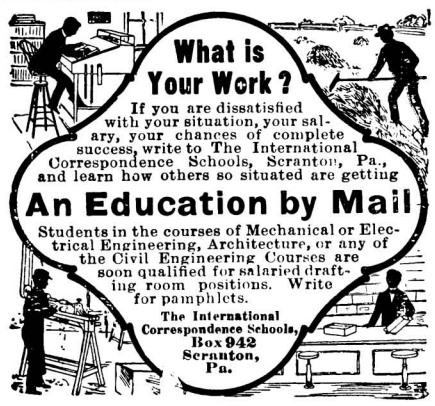
Distilled Water—100% Pure from the Sanitary Still.
TESTIMONIALS—Physicians' endorsements and full particulars by return mail.
Only Still recognized by the U. S. Government. Six Styles, $10 up.
THE CUPRIGRAPH CO., 188 No. Green St., Chicago.

© 1899 SCIENTIFIC AMERICAN, INC.

CAN I BECOME AN ELECTRICAL ENGINEER?

The Electrical Engineer Institute of Correspondence Instruction,
Department A, 120-122 LIBERTY STREET, NEW YORK, U. S. A.

YES; YOU CAN. WE TEACH ELECTRICAL ENGINEERING at your home, by mail, payable in installments of $5.00 or $2.00 per month. Over 20 Technical and popular courses. Our Institute indorsed by THOS. A. EDISON and every other prominent electrician. The electrical field is growing enormously and offers excellent opportunities to make money for those having an electrical training. It will pay anyone to **write for our two free books** entitled "Can I Become an Electrical Engineer" and "The Electrical Marvels of Our Times."



What is Your Work?

If you are dissatisfied with your situation, your salary, your chances of complete success, write to The International Correspondence Schools, Scranton, Pa., and learn how others so situated are getting

An Education by Mail

Students in the courses of Mechanical or Electrical Engineering, Architecture, or any of the Civil Engineering Courses are soon qualified for salaried drafting room positions. Write for pamphlets.

The International Correspondence Schools, Box 942 Scranton, Pa.

WATCHMEN!!

can well protect if armed with a

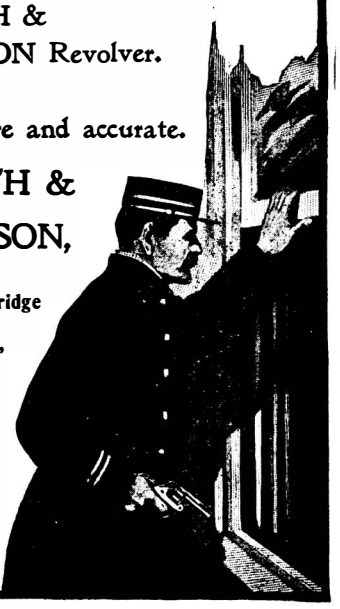
SMITH & WESSON Revolver.

Quick, sure and accurate.

SMITH & WESSON,

14 Stockbridge Street, Springfield Mass.

Catalogue for a stamp.



Reversible LINENE Collars and Cuffs.

Stylish, convenient, economical. Made of fine cloth, finished in pure starch, and exactly resemble fashionable linen goods. ***No Laundry Work*** When soiled discard. Ten Collars or five pairs of Cuffs, 25cts. *By mail, 30cts.* Send 6 cts. in stamps for sample collar and pair of cuffs. Name size and style.

REVERSIBLE COLLAR CO., Dept. J, Boston, Mass.

SEE THAT CLIP?

Agents Wanted.

The Niagara Clip holds securely from the thinnest sheet of paper up to 3/8 inch in thickness, and can be used over and over again. Better than pins for filing letters, records, cards, etc. Avoid unsightly pin holes in attaching second letters, business cards, checks, drafts, invoices, etc. Put up in boxes of 100 especially for desk convenience. Sample Box, 20 Cents, postage paid.

NIAGARA CLIP COMPANY, 34 Broadway, N. Y. City

The Ladies' Delight

The Robinson Thermal Bath Cabinet.
The only bath that makes you clean.
The only bath that makes you well.
The only bath that makes beautiful Complexion.

Men enjoy it better than Turkish Baths.

Prices $3.50, $7.50 and $12.50.

Our Cabinet opens at top to cool off; others do not. Awarded First Premium at Omaha Exposition.

Over Four Hundred Thousand Cabinets in use. Every ailment can be cured or benefited. **The Robinson Cabinet** folds like a screen into six inch space. **It is patented.** Beware of infringements, as you are liable to prosecution. **We sell on 30 days trial.** Get a Cabinet and **purify your blood** before Hot Weather. Send for **free** book, "Health and Beauty," and treatment on all diseases. We have a Branch Office in every large city, where our Cabinet can be seen before purchasing. Good agents wanted. We furnish capital. Write at once

ROBINSON THERMAL BATH CO., 700-717 Jefferson Street, TOLEDO, OHIO

Weighing machine, F. H. Richards	624,379
Wheel, W. L. Huffman	624,036
Wheel center, Evans & Healey	624,005
Whiffletree hook, H. Olson	624,373
Whist board, duplicate, M. C. Ryan	624,104
Wick raiser locking device, E. E. Northway	624,074
Winches, anchoring means for power, H. C. Goddard	624,010
Window lock, swinging, T. B. Stevens	624,120
Window screen, G. A. Youlden	624,418
Wire drawing machine, C. Harmann	624,018
Wire strainer, J. D. Walsh	624,273
Wires, machine for wrapping stay wires around line, W. McCloskey	624,072
Wrench. See Pipe wrench.	
Wrench, A. H. Anderson	624,149
Wrench, J. N. Hill	624,211

DESIGNS.

Abdominal band, A. Wardroper	30,700
Badge, W. H. Craft	30,644
Badge, M. T. Graf	30,645
Bicycle stirrup upper, C. F. Whaley	30,667
Bottle, F. Schilling	30,664
Box blank, W. T. Boyd	30,706
Brick, E. Paquette	30,707
Brush, R. Lindsley	30,663
Can cover, A. E. Dulmage	30,672
Converter box, F. Schwedtmann	30,683 to 30,690
Corner dust guard, C. W. Withington	30,684, 30,685
Cream separator column, H. N. Gagel	30,673
Cultivator frame, W. L. Beall	30,680
Dental chair supporting piece or plunger, E. M. Fredericks	30,693
Die for forging bodies of rotary trimmer cutters, E. Childs	30,677
Door check frame, C. M. Burgess	30,691, 30,692
Electrode, storage battery, T. A. Willard	30,687
Eraser holder, L. W. Faber	30,655
Fabric, warp net, F. O. Haubner	30,709
Finger ring, C. H. Pfeil	30,647
Fire cracker body, C. L. Curtis	30,658
Fire cracker charge and stem, L. Nordlinger	30,659
Flower holder for personal wear, C. N. Littlehale	30,653
Furnace body, D. S. Richardson	30,681
Gas burner, H. F. Gabel	30,668
Golf stick handle, W. A. Griffith	30,708
Graft cutting blade, J. W. Wood	30,675
Grooving tool blank, T. E. O'Brien	30,671
Helmet, C. F. Lehmann	30,702
Knife, paring, H. H. Sheely	30,674
Lace fastener, Pardee & Judson	30,652
Ladle or similar article, W. A. Jameson	30,648
Lamp, L. C. Tiffany	30,665
Lamp, acetylene gas bicycle, C. Kelly	30,666
Lamp casing, electric arc, C. E. Harthan	30,686
Legging, C. S. & A. S. Huntington	30,703
Locket, B. M. Graff	30,646
Locomotive tender coupling, S. J. Meeker	30,682
Locomotive tender coupling bracket plate, S. J. Meeker	30,683
Manhole cover, T. P. Greger	30,695 to 30,697
Manhole cover frame, T. P. Greger	30,694
Match, G. R. Ford	30,656, 30,657
Medal or similar article, H. K. Solberg	30,643
Metal stock, R. Dulk	30,670
Necktie holder, D. Haslup	30,701
Paper trimming machines, cutting blade for wall, A. Allen	30,676
Pincushion, C. Jones	30,705
Pipe member, tobacco, W. C. Cunningham	30,660, 30,661
Pumping power base, K. Chickering	30,698
Screw cap, C. M. Higgins	30,669
Skirt and shoe protector, G. S. Hensel	30,704
Spool thread holder, H. Straussberg	30,654
Spoon, W. A. Jameson	30,649
Spoon, E. A. Muth	30,650
Spoon, J. E. Schmitt	30,651
Suppository, C. L. Trusler	30,699
Tobacco package, G. Millhiser	30,662
Trimmer cutter body, rotary, E. Childs	30,678
Washing machine rubber, C. I. Fuller	30,679

TRADE MARKS.

Antirheumatic, Farbenfabriken of Elberfeld Company	32,805
Antiseptic and a remedy for certain named diseases, Dr. A. H. Keller Chemical Company	32,801
Bitters, J. P. Mette	32,807
Canned goods, certain named, John Boyle Company	32,816
Cigarettes, American Tobacco Company	32,806
Coffee, P. B. Hunt	32,811
Cure for certain named diseases, Consolidated Medicine Company	32,802
Embalming fluid, Imperial Fluid Company	32,797
Enameled ware, certain named, J. C. Dowd & Company	32,820
Flour, C. C. Leinweber	32,818
Foods, cereal breakfast, Elgin Breakfast Food Company	32,817
Fruits, tinned, Rowland & Harrison	32,814, 32,815
Game, Milton Bradley Company	32,789
Hat finishers' labels, Wharton & Company	32,790
Hats, Ferry & Napier	32,783, 32,784
Hearing, instrument to assist the, R. C. M. Bowles	32,792
Hosiery, F. M. Farber	32,785
Lamps, vehicle and bicycle, E. J. Dolan	32,819
Lotions and ointments, perfumed, A. Peter & Company	32,799
Machines, certain named, Sager Gear Company	32,823
Malt extract, A. G. Hupfel's Sons	32,810
Milk, condensed, J. Butler	32,812
Milk, condensed, firm of H. Nestle	32,813
Optical goods, certain named, American Optical Company	32,787
Pens, Turner & Harrison	32,788
Pills and liquid laxatives, A. Peter & Company	32,798
Pills, tonics, ointments, or lotions, A. Peter & Company	32,800
Plastic building material, American Monolith Company	32,794
Polish for leather, metal, or wood, Lane & Fitte	32,793
Polish, liquid, Carter Chemical Company	32,795
Powders, hog, chicken, and cattle, A. A. Gery	32,796
Remedies for a certain named disease, Shafer & Bradrick	32,804
Remedies for coughs, colds, headaches, and la grippe, Paris Medicine Company	32,803
Scales, Buffalo Scale Company	32,821
Stoves and ranges, Thomas White Stove Company	32,822
Wax, sealing, I. Lambert	32,791
Whisky, A. B. Sheaffer	32,808
Whisky, Steiner & Strauss	32,809
Woven fabrics, C. Stohn's Sons	32,786

LABELS.

"Centennial City Pure Rye Whisky," for bottled whisky, S. Behr	6,904
"Dr. James' Miniature Headache Powders," for headache powders, J. W. James Company	6,907
"Edelweiss Rocky Mountain Herbs Breast Tea," for an herb compound, R. Bloomer	6,905
"Ely's Cin-Cho Tonic," for medicine, Ely Medicine Company	6,906
"French's Pure Gold," for jelly, R. T. French Company	6,901
"Jersey Dairies," for condensed milk, Charles E. Hires Company	6,902
"Leila Kanum Company, Cleopatra's Charm," for a cosmetic, H. S. Decker	6,908
"Morro Castle," for condensed milk, Charles E. Hires Company	6,903
"Sure Cure Salve," for a salve, Keske Brothers	6,909

PRINTS.

"Everything Electric," for electrical appliances, W. D. Marrow	133
"H. W. Johns' Asbestos Roofings," for insulating materials, etc., H. W. Johns' Manufacturing Company	134
"Prince of Wales Egyptian Cigarettes," for cigarettes, Manz Photographing Company	132
"Wahl's Bouillon," for bouillon, Bouillon Stock Manufacturing Company	131

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

IT'S EASY MONEY

For You to Obtain an Education which will Qualify You for a Better Position and enable You to Earn More

if you will devote some of your spare time to study at home, at a cost so low that you will not feel the outlay. Courses by mail in **Electrical, Mechanical, Civil, Mining, Steam** and **Sanitary Engineering, Architecture, Mechanical Drawing, Machine Design, etc.** *Best Text Books Free.* Write for Circular S. A., sample pages of text books, drawing plate, and booklet of letters from students all over the world.

The United Correspondence Schools, 154, 156 & 158 Fifth Ave., New York

IF YOU SHOOT A RIFLE, Pistol or *Shotgun*, you'll make a **Bull's Eye** by sending three 2c. stamps for the *Ideal Hand-book* "A," 126 pages **FREE.** The latest Encyclopedia of *Arms, Powders, Shot and Bullets.* Mention SCIENTIFIC AMERICAN. Address

IDEAL MFG. CO., NEW HAVEN, CONN., U. S. A.

Powerful, Responsive, Durable and Efficient.

"REEVES" Variable Speed Counter Shaft

for securing any speed without change of belt or loss of time. Specially adapted for all kinds of experimental machinery, Printing Presses, Motor Carriages, Ironworking Tools, Woodworking Machinery, or any and all machines requiring a change of speed or feed.

☞ *Send for handsomely illustrated Catalogue "S. A." free.*

REEVES PULLEY CO., Columbus, Ind., U. S. A.

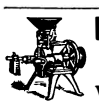
$5 to $30 3000 BICYCLES

Everyone a Bargain.

NEW AND SECOND HAND.

2d Hand—good as any for service. $5 to $12. **New '99 Models** $12.50 to $30. None higher. We guarantee to save you money. Largest variety to select from. Lowest prices ever quoted. Every customer satisfied. Shipped subject to examination and approval. No money in advance. A few good AGENTS WANTED. For price listand particulars address the old reliable cycle house,

BROWN-LEWIS CO., (F F) 293 Wabash Av., Chicago.



BONE MILLS for RAW BONES

(F. Wilson Patent.) Capacity from one-half ton to 40 tons.

WILSON BROS., Easton, Pa., U.S.A.

KNOWLEDGE THAT PAYS

HEALTH, STRENGTH, BEAUTY and WEALTH.

Every portion of the body enlarged and strengthened. Will Power and Personal Magnetism developed. Simple, scientific methods. Philosophy of success as demonstrated daily. Interesting reading free.

Prof. L. H. Anderson, S. A. 59, Masonic Temple, Chicago.

PROPOSALS.

SEALED PROPOSALS WILL BE RECEIVED AT the office of the Lighthouse Engineer, Tompkinsville, N. Y., until 12 o'clock m., of Thursday, the 25th day of May, 1899, and then opened, for furnishing and delivering metal work for West Bank Light-Station, New York, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to

D. P. HEAP, Lieut. Col., Corps of Engineers, U. S. A.

SEALED PROPOSALS WILL BE RECEIVED AT the office of the Lighthouse Engineer, Tompkinsville, N. Y., until 12 o'clock m., of Thursday, the 25th day of May, 1899, and then opened, for erection and delivery of West Bank Light-Station, New York, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to

D. P. HEAP, Lieut. Col., Corps of Engineers, U. S. A.

SEALED PROPOSALS.

COMPTROLLER'S OFFICE, CITY OF NEW ORleans New Orleans, April 28th, 1899 Pursuant to Ordinance No. 15194, sealed proposals will be received at this office until the hour of 2.30 p. m., Monday, May 29th, 1899, for the furnishing of a fire alarm system for the City of New Orleans, in accordance with specifications in the office of the City Electrician. Deposit of $300. Bond with surety company in the sum of $20,000. Bidders must have paid their city license in order that their bids may be accepted. The city reserves the right to reject any and all bids.

W. S. DOUGLASS, Comptroller.

SCIENTIFIC BOOKS Open Court Publishing Co., Chicago.

MODEL MAKER I make Models for Electrical and Mechanical Appliances, also fine machinery. M. SANGER, 62 Cortlandt St., NEW YORK.

MODELS & GEARS CATALOGUES FREE. UNION MODEL WORKS 193 CLARK CHICAGO.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

ACETYLENE DEALERS' HAND BOOK Information net. 42 pp. 10 cts. F. CORTEZ WILSON & CO., Chicago

TURBINES ☞ Send for Circular "M." JAS. LEFFEL & CO. Springfield, Ohio, U. S. A.

Do you want an up to date Vapor launch & one to forty horse power. Write to us for prices.
Racine Yacht & Boat Works, Racine Junction, Wis.

Our Folding Boats are puncture proof. Galvanized steel ribbing. For hunting, fishing, exploring and family pleasure. Walter Wellman took them on his polar trip. Lieut. Schwatka explored the Yukon with them. Awarded first premium at World's Fair. Send 6 c. for catalogue. 40 engravings. **KING FOLDING CANVAS BOAT CO., Kalamazoo, Mich.**

GAS AND GASOLINE ENGINES WATER MOTORS

BACKUS WATER MOTOR CO. NEWARK N. J. U. S. A.

GRINDING MILLS FOR ALL PURPOSES. Bogardus Patent Universal Eccentric Mill. Address **J. S. & G. F. SIMPSON, 28 Rodney Street, Brooklyn, N. Y.**

Wanted.—Foreman or Assistant Superintendent with sufficient knowledge to install an oil engine plant. State references and salary required. J. Littlejohn, Toronto Junction, Ontario.

WANTED—Few honest men with some means, to help secure and place on market attested inventions and patents. Good money to right parties Steady employment. Address Lemuel Buis, 1920 Center Street, Little Rock, Ark.

WANTED A large quantity of rails that are defective in appearance, weight from 8 to 50 lbs. per yard, for cash. I will also take railroad rails that are defective in appearance that are offered at the lowest price. Address offers under **A. D. 283,** to RUDOLF MOSSE, Magdeburg, Germany.

50 YEARS' EXPERIENCE

PATENTS

TRADE MARKS DESIGNS COPYRIGHTS &c.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, **New York**

Branch Office, 625 F St., Washington, D. C.

To Authors: Manuscripts required. **We Publish** A new book every day in the year.

TENNYSON NEELY, Publisher, 114 Fifth Avenue, NEW YORK.

YOU CAN MAKE $100. A WEEK!
OWN YOUR OWN SHOW. COMPLETE OUTFIT—$100.
LIFE MOTION FILMS & MACHINES.
GREAT PASSION PLAY & 500 OTHER SUBJECTS
ILLUSTR. CATALOGUES FREE.
S. LUBIN, LARGEST MFR. PHILADELPHIA P. A.

NOVELTIES & PATENTED ARTICLES

Manufactured by Contract. Punching Dies, Special Machinery. E. Konigslow & Bro., 181 Seneca St., Cleveland, O.

FOR SALE.

Light Water Power, Building and Residence.—With about 3 acres land, plenty fruit. Situated in village of about 500 inhabitants. RR. Good schools and 3 churches Correspond with **C. S. Chamberlain & Son, Hannibal, N. Y.**

STEEL TYPEWRITER TYPE

TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

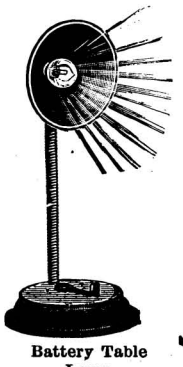
ROSE POLYTECHNIC INSTITUTE

A College of Engineering. Mechanical, Electrical, Civil Engineering; Chemical Courses; Architecture. Extensive shops. Modernly equipped laboratories in all departments. Expenses low. 17th year. For catalog address C. L. MEES, President, Terre Haute, Ind.

DO YOU WANT a BARGAIN? DO YOU WISH to sell?
MAGIC LANTERNS WANTED AND FOR SALE OR EXCHANGE
HARBACH & CO. 809 Filbert St. Phila. Pa.

Experimental & Model Work

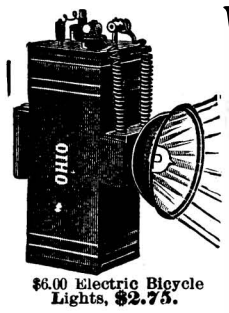
Cir. & advice free. Wm. Gardam & Son, 45-51 Rose St., N. Y.



Battery Table Lamp, **$2.75** complete.

Necktie Light.

$1.00 Motor.



$6.00 Electric Bicycle Lights, **$2.75.**

We Are Selling

$3.00 Electric Bell Outfits for	$1.00
21.00 Telephones, complete, for	5.95
12.00 Fan Motors, with Batteries	5.95
8.00 Electric Hand Lanterns for	3.00
10.00 Electric Carriage Lights for	3.95
8.00 Medical Batteries for	3.95
5.00 Electric Belts, the genuine	1.00
3.00 Necktie Lights, for	1.50
14-Candle Hanging Lamp, with Battery, for	10.00
Telegraph Outfits, complete, for	2 25
Miniature Electric Lamps for	.40
Sewing Machine Motors for	5.00

All Electrical Books at low prices.

We Undersell All on Everything Electrical.

OHIO ELECTRIC WORKS, CLEVELAND O.

Headquarters for Electric Novelties and Supplies.

☞ *Agents Wanted.* ☞ *Send for New Catalogue just out.*

© 1899 SCIENTIFIC AMERICAN, INC.

THOROUGH INSPECTIONS AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY STEAM BOILER EXPLOSIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

J. M. ALLEN, PRESIDENT — W. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY — F. B. ALLEN, 2D VICE PRESIDENT
L. B. BRAINERD, ASST TREAS. — L. F. MIDDLEBROOK, ASST SEC'Y

A Road Locomotive

it might be called, but it does not take an engineer to run it.

The Winton Motor Carriage

is distinguished for its simplicity and ease of operation and any one of ordinary ability can care for and use it. Clean, quiet, durable, economical and satisfactory. Hydro-Carbon system.

Price $1,000. No Agents.

Write for Free Catalogue and when you can secure delivery

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.

"PEGAMOID" TRADE MARK

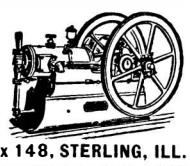
ALUMINUM PAINT.

Latest application of Aluminum. Looks like Frosted Silver. Washable, Untarnishable, Water, Oil and Weatherproof. Durable, Easily Applied. Bicycles, Yachts, Radiators, Pipes, Metal Work, Machinery, Dynamos, Motors. Apparatus, Arc Lamps, Sockets, Brackets. Cars, Stations, General Decoration, etc. Sample bottle, by mail, for 25 cents.

THE AMERICAN PEGAMOID CO., 346 B'way, New York.

CHARTER Gasoline Engine

USED ANY PLACE BY ANYONE FOR ANY PURPOSE



Stationaries, Portables, Engines and Pumps.

State your Power Needs.

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

TANKS

(Louisiana Red Gulf Cypress a Specialty.) Best known for every purpose. Good material Correct Workmanship. Low Prices *Get our Illustrated Catalogue.* W. E. Caldwell Co. 223 E. Main St., Louisville, Ky.

MACHINERY AND SPECIAL TOOLS FOR THE MANUFACTURE OF MOTOR VEHICLES

THE J. E. COSTILO MACHINE WORKS, 170 Hudson Avenue, Brooklyn, N. Y.

HELMET OIL LUBRICATES ANYTHING. IF YOU HAVE A HOT BOX TRY IT. C. H. BESLY & CO. CHICAGO, ILL. U.S.A.

H. & R. Arms Co.'s Hammerless

32 and 38 Caliber S. & W. Cartridges, Automatic Shell Ejecting. Positive Stop on Cylinder.

AN ABSOLUTELY SAFE ARM.

HARRINGTON & RICHARDSON ARMS CO. WORCESTER, MASS., U. S. A.

Send for Descriptive Catalogue "S."

The Victor Automobile

Marks a new era in the use of steam, and steam is pre-eminently the power to use on Automobiles.

We have solved the problems which have heretofore prevented the use of steam in the hands of the general public.

With a Victor Automobile it is possible to go for 25 miles and do absolutely nothing, except put the power on by opening the throttle, and steering it.

The water is maintained automatically in the boiler, and is guaranteed not to vary one inch.

The pressure on the fuel tank is maintained automatically, and is guaranteed not to vary one pound.

Other details have been put to rights, and we are prepared to guarantee satisfaction in road work.

Orders will be received for the wagon illustrated herewith at $1.000, to be delivered in July, and guaranteed to be satisfactory in road work before payment.

These wagons will have four horse power, and will be geared according to the hill climbing or speeding necessities of the purchaser.

Victor bicycle riders will know that our twenty years' experience as bicycle builders has enabled us to produce an Automobile fit to take its place in the family of Victors.

OVERMAN WHEEL CO.,

Chicopee Falls, Mass.

. . THE GUARANTEED WHEEL . .

Bevel Gear Chainless, $60.

QUALITY is the vital consideration in the making of Crescent Bicycles. Steadfastly maintained, it is the foundation of the past and future achievements of the wheel

CRESCENT BICYCLES

THE PRICES of Crescent Bicycles are guaranteed and rigidly maintained throughout the seasons — low enough to be practical and high enough to cover a first grade product

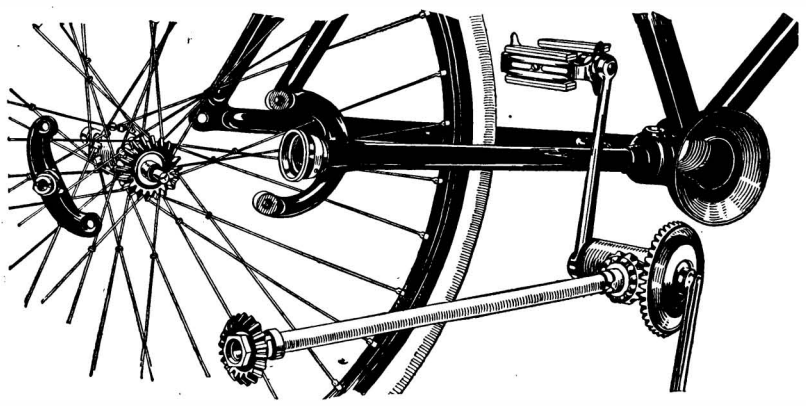
Adults' Chain Models, $35.

Juvenile Models, (24-inch wheels,) $25.

CATALOGUE No. 3, CONTAINING "CARE OF THE WHEEL," FREE.

CHICAGO. WESTERN WHEEL WORKS, NEW YORK.

Columbia Bevel-Gear Chainless Bicycle



Easiest running, cleanest, safest, most durable. Complete protection of running gear from rain, mud and dust. The best hill-climber and a delightful coaster.

COLUMBIA AND HARTFORD CHAIN WHEELS

The new specially cut sprockets and hardened pin chain show better results under test than any other chain wheel mechanism.

New Models: Chainless, $75; Chain, $50, $35, $26, $25.

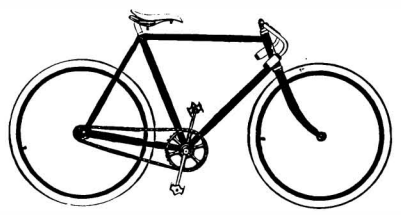
Catalogue free of any Columbia dealer or by mail for 2-cent stamp.

POPE MANUFACTURING CO., HARTFORD, CONN.

LATHES Foot Power, High Grade W. P. Davis Mach. Co., Rochester, N.Y.

Tribune Bicycles for 1899.

The Best Wheels in the World.

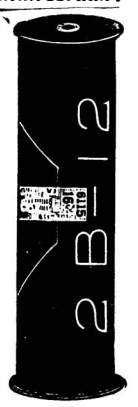


Write for large New Catalogue illustrating our full line of twenty-three models.

The Black Mfg. Co., Erie, Pa.

There is no Kodak but the Eastman Kodak.

By the KODAK SYSTEM



FILM CARTRIDGE.

of film photography the instrument loads and unloads in broad daylight.

The film is put up in cartridge form and is perfectly protected from light by a strip of black paper extending the full length of the film and several inches beyond each end.

To load: simply insert this cartridge in the Kodak; thread up the black paper; close the camera and give the key a few turns, thus bringing the film into position.

The picture taking may then begin. The roll of a dozen exposures being completed the black paper covers all, and the cartridge can be removed as easily as it was inserted.

Film Cartridges weigh ounces where plates weigh pounds and are non-breakable. All Kodaks use light-proof film cartridges and load in daylight.

Kodaks $5.00 to $35.00.

EASTMAN KODAK CO. Rochester, N. Y.

Catalogues free at the dealers or by mail.

CRITERION TRADE MARK ACETYLENE GAS BICYCLE LAMP

$2.50 The Criterion Lamp makes cycling at night SAFE and PLEASURABLE. Weighs less and costs less than any other good lamp on the market. Ladies delight in its simplicity. Send $2.50 in money order or New York draft. We make Acetylene Gas Generators for all purposes, also Magic Lanterns and Stereopticons in use by thousands of experts.

J. B. COLT & CO., Dept. "N,"

3 TO 7 WEST 29TH ST., NEW YORK,
189 La Salle Street, CHICAGO.
131 Post Street, SAN FRANCISCO.

CARBORUNDUM GRINDING MATERIALS IN ALL FORMS.

THE CARBORUNDUM CO., - NIAGARA FALLS, N. Y.

DUNLOP DETACHABLE TIRES seldom puncture and are easily repaired.

These are the only tools you'll need.

Get our Booklet of any dealer or of us

THE AMERICAN DUNLOP TIRE CO., Belleville, N. J. Chicago, Ill.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago Ill.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC. WM JESSOP & SONS LTD 91 JOHN ST. NEW YORK

PRINTING INKS

The SCIENTIFIC AMERICAN is printed with CHAS ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

© 1899 SCIENTIFIC AMERICAN, INC.